SOIL SURVEY OF

Mesa County Area, Colorado

United States Department of Agriculture
Soil Conservation Service

In cooperation with
Colorado Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all who need the information, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1959–69. Soil names and descriptions were approved in 1970. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1969. This survey was made cooperatively by the Soil Conservation Service and the Colorado Agricultural Experiment Station. It is part of the technical assistance furnished to the Mesa Soil Conservation District. Financial assistance for the survey of the Colorado National Monument part was provided by the National Park Service, U.S. Department of the Interior.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and wildlife areas; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Mesa County Area are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the range site in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units.

Wildlife managers and others can find information about soils and wildlife in the section "Wildlife."

Ranchers and others can find, under "Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Community planners and others can read about soil properties that affect the choice of sites for nonindustrial buildings and for recreation areas in the engineering section.

Engineers and builders can find, under "Engineering," tables that contain estimates of soil properties and information about soil features that affect engineering practices.

Scientists and others can read about the soils in the section "Formation and Classification of the Soils."

Newcomers in the area may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "General Nature of the Area."

Cover: Native range in an area of Mayflower-Skyway soils.

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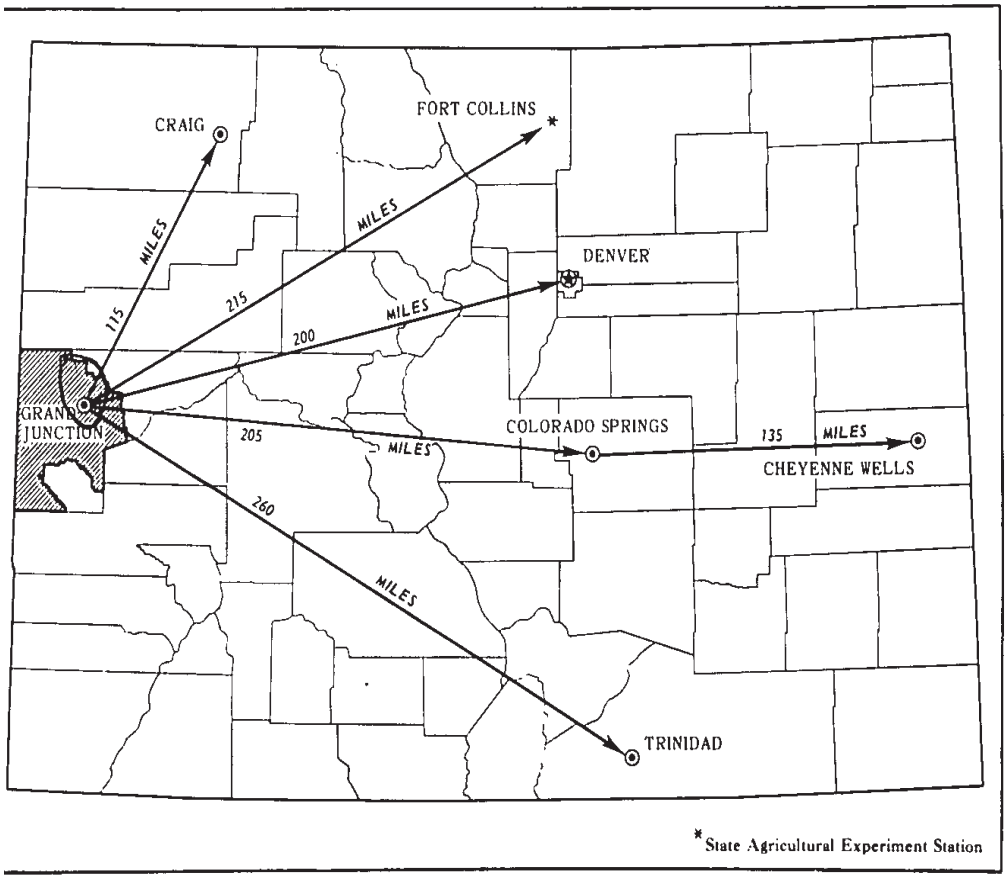

Location of Mesa County Area in Colorado.

SOIL SURVEY OF MESA COUNTY AREA, COLORADO

By Clayton F. Spears and Evan V. Kleven, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service, in cooperation with the Colorado Agricultural Experiment Station

THE MESA COUNTY AREA is in the western part of Colorado. It takes in about 1,040,260 acres, or 1,756 square miles. Grand Junction, the county seat, is in the northeastern part of Mesa County, just outside the survey area.

Most of the area is used for range. Raising beef cattle and sheep are the main enterprises. Recreation is of growing importance. A very small part, about 1,000 acres, of the area is used for irrigated crops.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in the Mesa County Area, where they are located, and how they can be used. The soil scientists went into the county knowing they were likely to find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in this survey.

Soils that have a profile almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. Avalon and Glenberg, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Avalon loam is one of several phases within the Avalon series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map that are identified by a common symbol are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of Mesa County Area: soil complexes and soil associations.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. An example is Nelman-Lazear sandy loams, 3 to 12 percent slopes.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils, joined by a hyphen. Fruita-Avalon association, undulating, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called miscellaneous areas and

are given descriptive names. Gullied land is a miscellaneous area in the Mesa County Area.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in the survey area. A soil association is a landscape that has a distinctive pattern of soils in defined proportions. It typically consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in an association can occur in other associations, but in different patterns.

A map showing soil associations is useful to people who want to have a general idea of the soils in a survey area, who want to compare different parts of that area, or who want to locate large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide for broad planning of a watershed, a wooded tract, or a wildlife area or for broad planning of recreation facilities, community developments, and such engineering works as transportation corridors. It is not a suitable map for detailed planning of management for a farm or field or for selecting a site for a road or building or other structure, because the soils within an association ordinarily vary in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The seven soil associations in this survey area are described on the pages that follow.

1. *Fruita-Avalon association*

Deep, nearly level to rolling, well-drained loam soils that formed in sediment from sedimentary rocks; on fans, benches, and high terraces

This association is in the northwestern part of the survey area. It consists mainly of benches and fans. The slope is 0 to 12 percent.

This association makes up about 5 percent of the survey area. About 50 percent of the association is made up of Fruita soils, 35 percent is Avalon soils, and the rest is minor soils.

Fruita soils are gently sloping to rolling. They are on benches and fans. In a representative profile the surface layer is brown loam about 5 inches thick. The subsoil is brown clay loam about 9 inches thick. The substratum is pinkish-gray loam about 12 inches thick. It is underlain by pinkish-gray clay loam that extends to a depth of 60 inches or more.

Avalon soils are level or nearly level to rolling. They are on high terraces and ridges. In a representative profile the surface layer is yellowish-brown loam about 6 inches thick. The layer below that is brown loam about 4 inches thick. The next layer is pink or white loam that extends to shale or sandstone at a depth of about 44 inches.

The minor soils in this association are Chipeta, Persayo, and Youngston soils. The Chipeta and Persayo soils are shallow and are underlain by shale. The Youngston soils are deep and are on flood plains.

This soil is used mainly for livestock grazing.

2. *Persayo-Badland-Chipeta association*

Shallow, gently sloping to steep, well-drained silty clay and silt loam soils that formed in residuum from shale and in rolling to very steep badlands; on uplands

This association is mainly north of the Colorado River and west of Grand Junction. The slope is 3 to 60 percent.

This association makes up about 16 percent of the survey area. About 30 percent of the association is made up of Persayo soils, 30 percent is Badland, and 25 percent is Chipeta soils. The rest is minor soils.

Chipeta soils are gently sloping to steep. They are on uplands. In a representative profile the surface layer is light-gray silty clay about 2 inches thick. The underlying layer is very pale brown and gray silty clay about 10 inches thick. It is underlain by slightly weathered marine shale.

Persayo soils are gently sloping to steep. They are on uplands. In a representative profile the surface layer is pale-yellow silt loam about 5 inches thick. The underlying layer is light brownish-gray silt loam that extends to yellowish-brown shale at a depth of about 16 inches.

Badland consists of barren or nearly barren hills and outcrops of gypsiferous marine shales and some clay. The landscape is rough and broken, and it has rolling hills that are separated by many narrow valleys or gullies.

The minor soils in this association are Fruita, Avalon, and Billings soils. Fruita and Avalon soils are deep and are on fans and benches and high terraces. Billings soils are deep and are on flood plains and terraces.

This association is used mainly for livestock grazing.

3. *Utaline-Nelman-Lazear association*

Deep to shallow, gently sloping to steep, well-drained stony loam, sandy loam, and gravelly loam soils that formed in materials weathered from basalt and sandstone; on high terraces, upland hills, and ridges

This association is mainly in the area southeast of Grand Junction. The slope is 3 to 30 percent.

This association makes up about 5 percent of the survey area. About 30 percent of the association is Utaline soils, 30 percent is Nelman soils, and 25 percent is Lazear soils. The rest is minor soils.

Utaline soils are deep and gently sloping to steep. They are on high terraces and terrace edges. In a representative profile the surface layer is pink stony loam about 4 inches thick. The underlying layer is pink, pinkish-white, and pinkish-gray very cobbly loam that extends to a depth of 60 inches or more.

Nelman soils are moderately deep over sandstone and gently sloping to rolling. They are on upland hills and ridges. In a representative profile the surface layer is pinkish-gray sandy loam about 6 inches thick. The underlying layer is light-brown or pink fine sandy loam about 20 inches thick to hard sandstone bedrock.

Lazear soils are shallow over hard sandstone and gently sloping to steep. They are on hillcrests and ridges. In a representative profile, the surface layer is light brownish-gray gravelly loam about 4 inches thick. The underlying layer is light-brown gravelly loam over hard sandstone bedrock at a depth of about 14 inches.

The minor soils in this association are Avalon and Blackston soils. These are deep soils on terraces. Also included in this association are small areas of Rock outcrop and Shale outcrop.

This association is used mainly for livestock grazing.

4. *Rock outcrop-Palma-Potts association*

Steep and very steep rock outcrop, and gently sloping to rolling, deep, well-drained sandy loam soils that formed in aeolian deposits; on uplands

This association is in the southern and central parts of the survey area. Rock outcrop is on very steep terrain, cliffs, and steep mesa edges. Palma and Potts soils are on upland hills and ridges. They have a slope of 3 to 12 percent.

This association makes up about 57 percent of the survey area. About 60 percent of the association is made up of Rock outcrop, 20 percent is Palma soils, and 10 percent is Potts soils. The rest is minor soils.

Included in mapping with the areas of Rock outcrop are areas of stony slopes and slides and small areas of shallow and very shallow, steep soils.

Palma soils are gently sloping to rolling. They are on upland hills and ridges. In a representative profile the surface layer is reddish-brown sandy loam about 4 inches thick. The subsoil is reddish-brown or light reddish-brown fine sandy loam about 24 inches thick. It is underlain by pink or yellowish-red sandy loam that extends to a depth of 60 inches or more.

Potts soils are deep and gently sloping to rolling. They are on upland hills and ridges. In a representative profile the surface layer is reddish-brown sandy loam about 4 inches thick. The subsoil is reddish-brown loam or clay loam and light-reddish brown loam about 20 inches thick. The substratum is light reddish-brown loam that extends to a depth of 60 inches or more.

The minor soils in this association are Batterson, Loma, and Dominguez soils. Batterson soils are shallow and on upland hills and ridges. Loma soils are deep and on mesas. Dominguez soils are deep and on alluvial fans.

This association is used mainly for livestock grazing. A few small areas are irrigated.

5. *Owen Creek-Miracle association*

Moderately deep, gently sloping to steep, well-drained fine sandy loam soils that formed in residuum from sandstone and shale; on mountain slopes, ridges, and mesas

This association is in the west-central and southwestern parts of the survey area. The slope is 3 to 30 percent.

This association makes up about 5 percent of the survey area. About 50 percent of the association is made up of Owen Creek soils, and 40 percent is Miracle soils. The rest is minor soils.

Owen Creek soils are moderately deep and gently sloping to steep. They are on mountain slopes, ridges, and small benches. In a representative profile the surface layer is dark grayish-brown fine sandy loam about 15 inches thick. The subsoil is brown sandy clay loam about 6 inches thick. The substratum is brown heavy clay loam about 9 inches thick over sandy shale and sandstone bedrock.

Miracle soils are moderately deep and gently sloping to rolling. They are on upland hills and mesas. In a representative profile the surface layer is brown fine sandy loam about 4 inches thick. The subsoil is brown or reddish-brown sandy clay loam about 26 inches thick. It is underlain by hard reddish-brown sandstone.

The minor soils in this association are Mayflower and Skyway soils and Rock outcrop. Mayflower and Skyway soils are moderately deep and are underlain by sandstone and shale.

This association is used mainly for livestock grazing.

6. *Mayflower-Cebone-Bangston association*

Deep and moderately deep, gently sloping to steep, well-drained silt loam, loam, and sandy loam soils that formed in sediments weathered from sandstone and shale; on mountain slopes and ridges

This association is in the west-central part of the survey area. It consists of mountain slopes, ridges, and benches. The slope is 5 to 40 percent.

This association makes up about 10 percent of the survey area. About 35 percent of the association is made up of Mayflower soils, 25 percent is Cebone soils, and 25 percent is Bangston soils. The rest is minor soils.

Mayflower soils are moderately deep and gently sloping to steep. They are on mountain slopes and ridges. In a representative profile the surface layer is dark-gray silt loam about 8 inches thick. The subsoil is reddish-gray and reddish-brown silty clay that extends to interbedded shale and sandstone at a depth of about 32 inches.

Cebone soils are moderately deep and gently sloping to steep. They are on mountain slopes, ridges, and benches. In a representative profile the surface layer is a dark grayish-brown loam about 13 inches thick. The subsurface is pinkish-gray fine sandy loam about 11 inches thick. The subsoil is reddish-brown and brown

clay about 14 inches thick. It is underlain by noncalcareous shale and sandstone.

Bangston soils are deep and gently sloping to steep. They are on upland hills and ridges. In a representative profile the surface layer is under a thin mat of decomposed organic material and is dark grayish-brown sandy loam about 9 inches thick. The underlying material is brown loamy sand that extends to a depth of 60 inches or more.

The minor soils in this association are Gateway and Skyway soils. Both soils are moderately deep and are underlain by sandstone and shale.

Mayflower soils are used mainly for livestock grazing. Cebone and Bangston soils are used for grazing and timber production.

7. *Ildefonso-Scholle-Stony land association*

Deep, gently sloping to rolling, well-drained cobbly sandy loam and stony loam soils that formed in sediments from mixed rocks and in moderately steep or steep stony land; on fans and upland slopes

This association is in the eastern part of the survey area. It consists mainly of fans and mountain slopes. The slope is 3 to 60 percent.

This association makes up about 2 percent of the survey area. About 30 percent of the association is made up of Ildefonso soils, 30 percent is Scholle soils, and 30 percent is Stony land. The rest is minor soils.

Ildefonso soils are gently sloping to rolling. They are on fans. In a representative profile the surface layer is brown cobbly sandy loam about 5 inches thick. The underlying layers are light-brown cobbly sandy loam and pinkish-white very cobbly sandy loam that extend to a depth of 60 inches or more.

Scholle soils are gently sloping to rolling. They are on fans and upland slopes. In a representative profile the surface layer is brown stony loam about 5 inches thick. The subsoil is brown stony silty clay loam about 7 inches thick. The substratum is pinkish-white stony loam that extends to a depth of 40 inches or more.

Stony land is on moderately steep or steep fans and mountain slopes. It consists of cobbles, boulders, and stones that are 10 to 200 feet thick or more.

The minor soils in this association are Utaline and Persayo soils. Utaline soils are deep and stony. Persayo soils are shallow over shale.

This association is used for livestock grazing and by wildlife.

Descriptions of the Soils

This section describes the soil series and mapping units in the Mesa County Area. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Color terms are for dry soil unless otherwise stated.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Rock land and Rock outcrop, for example, do not belong to a soil series, but nevertheless, are listed in alphabetic order along with the soil series.

Preceding the name of each mapping unit is a symbol that identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit and range site in which the mapping unit has been placed. The page for the description of each capability unit and range site can be learned by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*6*).[1]

Alluvial Land

Ad—Alluvial land. This mapping unit consists of very gravelly or cobbly sandy alluvium on flood plains that are nearly level. The areas are crisscrossed by meandering and braided stream channels. Most areas are subject to flooding one to several times a year. The vegetation is sparse and is mostly cottonwood, willow, sagebrush, rabbitbrush, grasses, and weeds.

These areas are used mainly by wildlife. They are valuable as a source of sand and gravel. Capability unit VIIIw–1; not placed in a range site.

Avalon Series

The Avalon series consists of deep, well-drained soils. These soils formed in sediment from sedimentary rocks on high terraces. The slope is 0 to 12 percent, and elevation is 4,900 to 5,400 feet. The natural vegetation is mainly saltbush, rabbitbrush, galleta, and Indian ricegrass. The average annual precipitation is 9 inches. The mean annual temperature is 54° F., and the frost-free season is 165 to 175 days.

In a representative profile the surface layer is yellowish-brown loam about 6 inches thick. The underlying layer is brown loam about 4 inches thick. It in turn is underlain by pink or white loam to a depth of about 44 inches. Shale or sandstone is below that depth.

Avalon soils have moderate permeability and a mod-

[1] Italic numbers in parentheses refer to Literature Cited, p. 55.

TABLE 1.—*Acreage and extent of the soils*

Soil	Approximate area	Proportionate extent
	Acres	*Percent*
Alluvial land	2,440	0.2
Avalon loam, 0 to 3 percent slopes	1,640	.2
Avalon loam, 3 to 12 percent slopes	13,360	1.3
Badland	93,880	9.0
Bankard loamy sand	4,440	.4
Batterson-Rock outcrop complex, 3 to 12 percent slopes	49,800	4.8
Billings silty clay loam	19,320	1.8
Blackston stony loam, 3 to 25 percent slopes	3,640	.3
Chipeta silty clay, 3 to 25 percent slopes	8,960	.9
Dominguez clay loam, 3 to 12 percent slopes	2,000	.2
Dwyer loamy sand, 3 to 12 percent slopes	14,400	1.4
Fruita-Avalon association, undulating	15,240	1.5
Gateway-Cebone-Bangston association, steep	33,880	3.2
Gateway-Cebone-Bangston association, very steep	9,640	.9
Gibbler-Witt association, undulating	3,080	.3
Glenberg sandy loam, 0 to 3 percent slopes	9,040	.9
Glenberg sandy loam, 3 to 8 percent slopes	8,560	.8
Gullied land	1,920	.2
Ildefonso cobbly sandy loam, 3 to 12 percent slopes	3,720	.4
Lazear-Rock outcrop complex, 3 to 30 percent slopes	10,160	1.0
Loma loam	3,720	.4
Mayflower-Skyway association, rolling	21,280	2.0
Miracle-Splitro association, undulating	28,400	2.7
Nelman sandy loam, 3 to 12 percent slopes	6,240	.6
Nelman-Lazear sandy loams, 3 to 12 percent slopes	3,200	.3
Owen Creek-Miracle complex, 3 to 12 percent slopes	17,880	1.7
Owen Creek-Miracle complex, 12 to 30 percent slopes	3,280	.3
Palma sandy loam, 3 to 12 percent slopes	19,720	1.9
Persayo silt loam, 3 to 25 percent slopes	46,200	4.2
Potts sandy loam, 3 to 12 percent slopes	26,040	2.5
Rock land	116,310	12.0
Rock outcrop	368,460	35.0
Scholle stony loam, 3 to 12 percent slopes	1,120	.1
Stony land	20,250	2.0
Uffens loam, 3 to 12 percent slopes	3,560	.3
Unaweep sandy loam, 3 to 12 percent slopes	5,000	.5
Utaline stony loam, 3 to 25 percent slopes	19,960	1.9
Utaline-Shale outcrop complex	8,400	.8
Wet alluvial land	840	.1
Youngston loam	11,280	1.0
Total	1,040,260	100.0

erate available water capacity. They are moderately alkaline. Roots can penetrate to a depth of 40 to 60 inches.

These soils are used for grazing, as wildlife habitat, and for recreation.

Representative profile of Avalon loam, 3 to 12 percent slopes, NE¼ sec. 25, T. 8 S., R. 102 N.

A11—0 to 6 inches, yellowish-brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) when moist; weak, platy parting to weak, fine, granular structure; soft, friable; calcareous; moderately alkaline; clear, smooth boundary.

AC—6 to 10 inches, light-brown (7.5YR 6/3) loam, dark brown (7.5YR 4/4) when moist; weak, moderate, subangular blocky parting to weak, fine, subangular blocky structure; slightly hard, friable; calcareous; moderately alkaline; gradual, smooth boundary.

C1ca—10 to 26 inches, pink (7.5YR 7/4) loam, brown (7.5YR 5/4) when moist; massive; slightly hard, friable; calcareous; moderately alkaline; gradual, smooth boundary.

C3—26 to 44 inches, white (10YR 8/2) loam, light brownish gray (10YR 6/2) when moist; massive; hard, very friable; calcareous; moderately alkaline; about 15 percent gravel.

IIC4—44 to 54 inches, weathered shale.

The A horizon is a very fine sandy loam or loam. The C horizon is gravelly loam or loam. Flakes, seams, and nodules of calcium carbonate are in the Ca horizon.

AvA—Avalon loam, 0 to 3 percent slopes. This soil is nearly level and is on high terraces.

Included with this soil in mapping are a few small areas of Blackston soils.

Runoff is slow. The hazard of water erosion is slight.

This soil is used mainly for grazing and recreation. Capability unit VIe–1; Loamy Salt Desert range site.

AvC—Avalon loam, 3 to 12 percent slopes. This soil is gently sloping to rolling and is on high terraces and ridges. It has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of Fruita and Persayo soils.

Runoff is moderate. The hazard of erosion is moderate.

This soil is used mainly for grazing and as wildlife habitat. Capability unit VIe–1; Loamy Salt Desert range site.

Badland

Ba—Badland. This mapping unit consists of a rough and broken succession of rolling to very steep, nearly barren hills and ridges separated by steep-walled, deeply entrenched gullies and canyons. Badland consists of gypsiferous shale that contains layers of sandstone outcrop along canyon walls. It produces a large amount of sediment.

Included with this unit in mapping are Chipeta and Persayo soils. These soils make up about 10 percent of the mapped area.

Vegetation on the included soils is mainly saltbush, sparse pinyon and juniper, and some grass.

Badland is used mainly as refuge areas for wildlife and as scenic areas. Capability unit VIIIe–1; not placed in a range site.

Bangston Series

The Bangston series consists of deep, well-drained soils. These soils formed in sediment weathered from sandstone on upland hills and ridges. The slope is 2 to 60 percent, and elevation is 8,000 to 8,500 feet. The natural vegetation is mainly spruce, fir, aspen, and grasses of the Subalpine zone. The average annual precipitation is 20 inches. The mean annual temperature is 38° F., and the frost-free season is 35 to 50 days.

In a representative profile the surface layer is under a thin mat of decomposed organic material and is dark grayish-brown sandy loam about 9 inches thick. The

underlying material is brown loamy sand that extends to a depth of 60 inches or more.

Bangston soils have rapid permeability and a low available water capacity. They are neutral. Roots can penetrate to a depth of more than 60 inches.

These soils are used for grazing, timber, and as wildlife habitat.

Representative profile of Bangston sandy loam, in an area of Gateway-Cebone-Bangston association, NE¼ sec. 29, T. 13 S., R. 101 W., in an area of timber.

O2—1 inch to 0, partly decomposed organic material, principally from leaves, needles, and grass.
A11—0 to 9 inches, dark grayish-brown (10YR 4/2) light sandy loam, very dark brown (10YR 2/2) when moist; weak, fine, crumb structure; soft, very friable; neutral; clear, smooth boundary.
A12—9 to 30 inches, brown (10YR 4/3) loamy sand, dark brown (10YR 3/3) when moist; single grained; soft, very friable; neutral; gradual, smooth boundary.
C—30 to 60 inches, brown (10YR 5/3) loamy sand, dark brown (10YR 4/3) when moist; single grained; soft, very friable; about 5 percent small fragments of sandstone; neutral.

The A horizon is sandy loam or heavy loamy sand. Fragments of sandstone make up as much as 15 percent of the C horizon. Bangston soils are mapped in this survey only as part of the Gateway-Cebone-Bangston association.

Bankard Series

The Bankard series consists of deep, well-drained soils. These soils formed in sandy alluvium on flood plains. The slope is 1 to 5 percent, and elevation is 4,900 to 5,200 feet. The natural vegetation is mainly saltbush, rabbitbrush, galleta, and annual weeds. The average annual precipitation is 10 inches. The mean annual temperature is 52° F., and the frost-free season is 165 to 175 days.

In a representative profile the surface layer is pale-brown loamy sand about 5 inches thick. The underlying layers are pale-brown or very pale brown loamy sand and fine sand.

Bankard soils have rapid permeability and a low available water capacity. They are moderately alkaline. Roots can penetrate to a depth of more than 60 inches.

These soils are used for grazing, as wildlife habitat, and for recreation.

Representative profile of Bankard loamy sand, SE¼ sec. 21, T. 8 S., R. 103 W.

A1—0 to 6 inches, pale-brown (10YR 6/3) loamy sand, brown (10YR 5/3) when moist; massive; slightly hard, very friable; calcareous; moderately alkaline; clear, wavy boundary.
C1—6 to 14 inches, pale-brown (10YR 6/3) fine sand, brown (10YR 5/3) when moist; single grained; soft, very friable; calcareous; moderately alkaline; clear, smooth boundary.
C2—14 to 26 inches, pale-brown (10YR 6/3) fine sand, dark brown (10YR 4/3) when moist; single grained; soft, very friable; calcareous; moderately alkaline; clear, smooth boundary.
C3—26 to 33 inches, pale-brown (10YR 6/3) loamy sand, dark brown (10YR 4/3) when moist; weak, fine subangular blocky structure; slightly hard, very friable; calcareous; moderately alkaline; clear, smooth boundary.
C4—33 to 64 inches, very pale brown (10YR 7/3) loamy sand, brown (10YR 5/3) when moist; massive; soft, very friable; calcareous; moderately alkaline.

The A horizon is fine sand or loamy sand.

Bd—Bankard loamy sand. This soil is nearly level to gently sloping and is on flood plains and low terraces. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Youngston soils.

Runoff is slow, and the hazards of soil blowing and water erosion are moderate to high. Gullies 4 to 6 feet deep are common. The soil is subject to flooding.

This soil is used mainly for grazing and as wildlife habitat. Capability unit VIIw–1; Salt Flats range site.

Batterson Series

The Batterson series consists of shallow, well-drained soils. These soils formed in residuum from sandstone on upland hills and ridges. The slope is 3 to 12 percent, and elevation is 6,000 to 7,500 feet. The natural vegetation is mainly pinyon, juniper, and Indian ricegrass and wheatgrass mixed with shrubs and forbs. The average annual precipitation is 14 inches. The mean annual temperature is 48° F., and the frost-free season is 110 to 125 days.

In a representative profile the surface layer is reddish-brown loamy sand about 4 inches thick. The underlying layers are reddish-brown and yellowish-red loamy sand; they in turn are underlain by hard reddish-brown sandstone at a depth of about 15 inches.

Batterson soils have rapid permeability and a low available water capacity. They are moderately alkaline. Roots can penetrate to a depth of 10 to 20 inches.

These soils are used for grazing, as wildlife habitat, and for watershed areas.

Representative profile of Batterson loamy sand, in an area of Batterson-Rock outcrop complex, 3 to 12 percent slopes, SW¼ sec. 19, T. 12 S., R. 102 W., in an area of grass.

A1—0 to 4 inches, reddish-brown (5YR 5/3) loamy sand, reddish-brown (5YR 4/3) when moist; weak, fine granular structure; soft, very friable; 10 percent is small fragments of sandstone; calcareous; moderately alkaline; gradual, smooth boundary.
AC—4 to 7 inches, reddish-brown (5YR 5/4) loamy sand that contains lenses of sandy loam, reddish brown (5YR 4/4) when moist; single grained; loose; 10 percent is small fragments of sandstone; calcareous; moderately alkaline; clear, smooth boundary.
C—7 to 15 inches, yellowish-red (5YR 5/6) loamy sand that contains lenses of sandy loam, yellowish red (5YR 4/6) when moist; single grained; loose; 20 percent is small fragments of sandstone; calcareous; moderately alkaline; abrupt, smooth boundary.
R—15 inches, reddish-brown calcareous sandstone.

The depth to sandstone is 10 to 20 inches. Fragments of sandstone make up 10 to 30 percent of the C horizon. In some profiles, soft lime has accumulated in the C horizon.

BrC—Batterson-Rock outcrop complex, 3 to 12 percent slopes. This complex is made up of shallow, gently sloping to rolling soils and areas of Rock outcrop on upland hills and ridges and along drainageways. It consists of about 60 percent Batterson loamy sand and 35 percent Rock outcrop. The Batterson soil has the profile described as representative of the series.

Included with this complex in mapping are Palma and Dwyer soils.

Runoff is medium. The hazard of erosion is moderate or high.

Pinyon and juniper trees are harvested for posts and firewood. Some areas of this complex are used for grazing. Capability unit VIIe–1; not placed in a range site.

Billings Series

The Billings series consists of deep, well-drained soils. These soils formed in alluvium on flood plains and low terraces. The slope is 0 to 3 percent, and elevation is 4,700 to 5,200 feet. The natural vegetation is mainly saltbush, rabbitbrush, galleta, and Indian ricegrass. The average annual precipitation is 10 inches. The mean annual temperature is 54° F., and the frost-free season is 165 to 175 days.

In a representative profile the surface layer is light brownish-gray silty clay loam about 3 inches thick. The underlying layers are brownish-gray silty clay loam that extend to a depth of 60 inches or more.

Billings soils have slow permeability and a high available water capacity. They are moderately alkaline. Roots can penetrate to a depth of more than 60 inches.

These soils are used for grazing, irrigated crops, and as wildlife habitat.

Representative profile of Billings silty clay loam, SE¼ sec. 27, T. 9 S., R. 104 W.

A1—0 to 3 inches, light brownish-gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) when moist; weak, thin, platy parting to weak, fine, granular structure; slightly hard, friable; moderately alkaline; clear, smooth boundary.

C1—3 to 12 inches, light brownish-gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) when moist; weak, medium, subangular blocky parting to weak, fine, subangular blocky structure; slightly hard, friable; strongly calcareous; moderately alkaline; gradual, wavy boundary.

C2—12 to 60 inches, light brownish-gray (10YR 6/2) silty clay loam; massive; hard, friable; strongly calcareous; moderately alkaline; seams and nodules of gypsum mostly in the lower 25 inches; several layers, about 1 inch thick of light brownish-gray (10YR 6/2) silty clay in lowermost 30 inches.

The A horizon is silty clay loam or silty clay. It is mildly alkaline or moderately alkaline.

Bs—Billings silty clay loam. This soil is nearly level and is on flood plains and low terraces. The slope is 0 to 3 percent. It has the profile described as representative of the series.

Included with this soil in mapping are areas of Youngston and Persayo soils. These soils make up about 10 percent of the mapped area.

Runoff is moderate, and the hazard of erosion is moderate. Deep gullies are common throughout most mapped areas of this soil. Gullies limit the beneficial effect of overflow and restrict use by man and animals.

The soil is used mostly as range. Small areas in the Kannah Creek and Whitewater Creek areas are used for irrigated corn, alfalfa, and pasture. Capability unit IIs–1 (irrigated), VIIs–2 (nonirrigated); Salt Flats range site.

Blackston Series

The Blackston series consists of deep, well-drained soils. These soils formed in sediment weathered from basalt on high terraces. The slope is 3 to 25 percent, and elevation is 4,800 to 5,500 feet. The natural vegetation is mainly saltbush, shadscale, rabbitbrush, galleta, and Indian ricegrass. The average annual precipitation is 9 inches. The mean annual temperature is 51° F., and the frost-free season is 160 to 175 days.

In a representative profile the surface layer is pinkish-gray gravelly loam about 5 inches thick. The underlying layers are pinkish-white gravelly loam and very gravelly loam; these extend to a depth of about 28 inches. Below these layers are sand, gravel, and cobblestones that extend to a depth of 60 inches or more.

Blackston soils have moderate permeability above a depth of 28 inches and rapid permeability below that depth. They have a low available water capacity, and they are moderately alkaline. Roots can penetrate to a depth of more than 60 inches.

These soils are used for grazing, as wildlife habitat, and for watershed.

Representative profile of Blackston stony loam, 3 to 25 percent slopes, SE¼ sec. 15, T. 2 S., R. 1 E., in an area of grass.

A1—0 to 5 inches, pinkish-gray (7.5YR 6/2) gravelly loam, brown (7.5YR 5/3) when moist; moderate, fine, granular structure, but weak, platy in the upper inch; soft, very friable; common dark mineral grains; 15 percent fragments of basalt, pebbles, and cobbles; calcareous; moderately alkaline; clear, wavy boundary.

C1ca—5 to 14 inches, pinkish-white (7.5YR 8/2) gravelly loam, light brown (7.5YR 6/3) when moist; massive; hard, very friable; common dark mineral grains; 40 percent basalt gravel; much, visible, finely divided secondary calcium carbonate; calcium carbonate equivalent about 25 percent; moderately alkaline; gradual, wavy boundary.

C2cam—14 to 28 inches, pinkish-white (7.5YR 8/2) very gravelly loam, light brown (7.5YR 6/3) when moist; massive; very hard, firm; some thin discontinuous lenses of weakly lime-cemented material; common dark mineral grains; 60 to 70 percent basalt gravel; visible secondary calcium carbonate, mostly finely divided; calcium carbonate equivalent about 30 percent; moderately alkaline; gradual, wavy boundary.

IIC3ca—28 to 60 inches, sand, gravel, and cobbles that have coarse fragments which are mostly basalt; common dark mineral grains; calcareous, some accumulated secondary calcium carbonate on underside of sand grains and pebbles; moderately alkaline.

The A1 horizon is gravelly sandy loam or gravelly loam.

BtD—Blackston stony loam, 3 to 25 percent slopes. This soil is gently sloping to steep and is on high terraces and benches. It has the profile described as representative of the series.

Included with this soil in mapping are areas of Utaline and Avalon soils; these make up as much as 10 percent of the mapped area. Also included in some places are small areas of soils, along terrace edges, that have shale or sandstone bedrock at a depth of about 36 inches.

Runoff is moderate to rapid. The hazard of erosion is moderate.

This soil is used mostly for grazing and as a source of gravel. Gravel pits and borrow areas are common. Capability unit VIe–1; Loamy Salt Desert range site.

Cebone Series

The Cebone series consists of moderately deep, well-

drained soils. These soils formed in sediment weathered from shale and sandstone on mountain slopes and ridges. The slope is 2 to 60 percent, and elevation is 8,000 to 9,500 feet. The natural vegetation is mainly spruce, fir, or aspen and grasses of the subalpine zone. The average annual precipitation is 20 inches. The mean annual temperature is 40° F., and the frost-free season is 35 to 50 days.

In a representative profile the surface layer is dark grayish-brown loam about 13 inches thick. The subsurface is pinkish-gray fine sandy loam about 11 inches thick. The subsoil is reddish-brown and brown clay about 14 inches thick. It is underlain by noncalcareous shale and sandstone.

Cebone soils have slow permeability and a low or moderate available water capacity. They are neutral. Roots can penetrate to a depth of 38 to 40 inches.

These soils are used for timber, grazing, and watershed.

Representative profile of Cebone loam, in an area of Gateway-Cebone-Bangston association, NW¼ sec. 7, T. 14 S., R. 10 W., in an area of timber.

A1—0 to 13 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; strong, fine, crumb and granular structure; soft, very friable; neutral; clear, smooth boundary.

A2—13 to 24 inches, pinkish-gray (7.5YR 7/2) fine sandy loam, brown (7.5YR 5/4) when moist; moderate, thick platy parting to moderate, fine, granular structure; soft, very friable; neutral; a few seams and nodules of more clayey material in the lower part; gradual, wavy boundary.

B2t—24 to 38 inches, reddish-brown (5YR 5/4) and brown (7.5YR 5/4) clay, reddish brown (5YR 4/4) and brown or dark brown (7.5YR 4/4) when moist, brown (7.5YR 5/4) when crushed, and brown or dark brown (7.5YR 4/4) when crushed and moist; moderate, coarse, subangular blocky structure; hard, very friable; thick, continuous, clay films on faces of peds and in root channels; neutral; gradual, wavy boundary.

C—38 inches, noncalcareous shale and sandstone.

The A1 horizon is very fine sandy loam or loam. Depth to shale or sandstone bedrock ranges from 20 to 40 inches.

Cebone soils in this survey are mapped only in associations with Gateway and Bangston soils.

Chipeta Series

The Chipeta series consists of shallow, well-drained soils. These soils formed in material weathered from shale on uplands. The slope is 3 to 25 percent, and elevation is 4,800 to 5,200 feet. The natural vegetation is mainly saltbush, rabbitbrush, galleta, and Indian ricegrass. The average annual precipitation is 9 inches. The mean annual temperature is 52° F., and the frost-free season is 165 to 175 days.

In a representative profile the surface layer is light-gray silty clay about 2 inches thick. The underlying layer is very pale brown and gray silty clay about 10 inches thick. It is underlain by slightly weathered marine shale.

Chipeta soils have slow permeability and a low available water capacity. They are moderately alkaline. Roots can penetrate to a depth of 12 to 17 inches.

These soils are used for grazing, as wildlife habitat, and for watershed.

Representative profile of Chipeta silty clay, 3 to 25 percent slopes, SE¼ sec. 23, T. 9 S., R. 104 W.

A1—0 to 2 inches, light-gray (10YR 7/2) silty clay, light brownish gray (10YR 6/2) when moist; weak, very fine, granular structure; hard, friable; calcareous; moderately alkaline; clear, wavy boundary.

C1ca—2 to 12 inches, very pale brown (10YR 7/3) and gray (10YR 6/1) silty clay, pale brown (10YR 6/3) when moist; weak, fine, subangular blocky structure; hard, firm; calcareous; moderately alkaline; clear, wavy boundary.

C2—12 to 26 inches, weathered Mancos shale.

The A1 horizon is silty clay loam or silty clay. Depth to shale ranges from 10 to 15 inches.

ChD—Chipeta silty clay, 3 to 25 percent slopes. This soil is gently sloping to steep and is on uplands. It has the profile described as representative of the series.

Included with this soil in mapping are areas of Persayo soils that make up about 10 percent of the mapped area and small areas of Badland. Also included are a few areas of a soil that has a surface layer of silt loam.

Runoff is moderate to rapid. The hazard of erosion is high.

The soil is used mainly for grazing. Capability unit VIIe–1; Clayey Salt Desert range site.

Dominguez Series

The Dominguez series consists of deep, well-drained soils. These soils formed in sediment weathered from calcareous shale. The slope is 3 to 12 percent, and elevation is 6,000 to 7,400 feet. The natural vegetation is mainly sagebrush, rabbitbrush, wheatgrass, and bluegrass. The average annual precipitation is 15 inches. The mean annual temperature is 50° F., and the frost-free season is 100 to 125 days.

In a representative profile the surface layer is brown heavy clay loam about 5 inches thick. The subsoil is reddish-brown heavy clay loam or clay about 20 inches thick. The substratum is reddish-brown clay about 22 inches thick.

Dominguez soils have slow permeability and a high available water capacity. They are moderately alkaline. Roots can penetrate to a depth of about 40 inches.

These soils are used for grazing, as wildlife habitat, and for watershed.

Representative profile of Dominguez clay loam, 3 to 12 percent slopes, NW¼ sec. 20, T. 11 S., R. 102 W., in an area of grass.

A1—0 to 5 inches, brown (7.5YR 5/3) heavy clay loam, dark-brown (7.5YR 4/3) when moist; moderate, fine, granular structure; soft, very friable; calcareous; moderately alkaline; clear, smooth boundary.

B21—5 to 9 inches, reddish-brown (5YR 5/3) heavy clay loam, reddish brown (5YR 4/3) when moist; weak, coarse, prismatic parting to moderate, medium, blocky structure; hard and extremely hard, very friable; ¼-inch to ½-inch cracks, when dry; few films of clay on vertical faces of peds; calcareous; moderately alkaline; clear, smooth boundary.

B22—9 to 25 inches, reddish-brown (5YR 5/3) clay, reddish brown (5YR 4/3) when moist; moderate, very coarse, prismatic parting to moderate, coarse, angular blocky structure; extremely hard, very plastic; few films of clay on vertical faces of peds; ½-inch to 1-inch cracks, when dry; many slickensides; calcareous; moderately alkaline; gradual, wavy boundary.

C1ca—25 to 35 inches, reddish-brown (5YR 5/3) clay, red-

dish brown (5YR 4/3) when moist; weak, very coarse, angular blocky structure; extremely hard, very plastic; ½-inch to 1-inch cracks, when dry; some visible concretions, thin seams, and streaks of secondary calcium carbonate; moderately alkaline; gradual, wavy boundary.

C2ca—35 to 47 inches, light reddish-brown (5YR 6/3) clay, reddish brown (5YR 4/3) when moist; weak, very coarse, angular blocky structure; extremely hard, very plastic; ½-inch to 1-inch cracks when dry; some visible concretions, thin seams, and streaks of secondary calcium carbonate; moderately alkaline.

DoC—Dominguez clay loam, 3 to 12 percent slopes. This soil is gently sloping to rolling and is on alluvial fans. It has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of Potts soils.

Runoff is moderate. The hazard of water erosion is high, and the hazard of soil blowing is slight.

This soil is used mostly for grazing and as wildlife habitat. Capability unit VIe–2; Clayey Foothills range site.

Dwyer Series

The Dwyer series consists of deep, excessively drained soils. These soils formed in aeolian sands on mesas and benches. The slope is 3 to 12 percent, and elevation is 6,000 to 7,400 feet. The natural vegetation is mainly big sagebrush, Indian ricegrass, bluegrass, and a few pinyon and juniper. The average annual precipitation is 16 inches. The mean annual temperature is 50° F., and the frost-free season is 100 to 125 days.

In a representative profile the surface layer is pinkish-gray loamy sand about 4 inches thick. The underlying layers are reddish-brown loamy sand and brown loamy fine sand that extend to a depth of 60 inches or more.

Dwyer soils have very rapid permeability and a low or moderate available water capacity. They are mildly alkaline in the upper 22 inches and moderately alkaline in the lowermost 38 inches. Roots can penetrate to a depth of more than 60 inches.

These soils are used for grazing, as wildlife habitat, and for watershed.

Representative profile of Dwyer loamy sand, 3 to 12 percent slopes, sec. 36, T. 11 S., R. 102 W., in an area of grass.

A1—0 to 4 inches, pinkish-gray (7.5YR 6/2) loamy sand, dark brown (7.5YR 4/2) when moist; single grained; loose, very friable; mildly alkaline; clear, smooth boundary.

C1—4 to 22 inches, reddish-brown (7.5YR 5/4) loamy sand, dark brown (7.5YR 4/4) when moist; single grained; soft, very friable; mildly alkaline; gradual, smooth boundary.

C2—22 to 60 inches, brown (7.5YR 5/4) loamy fine sand, dark brown (7.5YR 4/4) when moist; single grained; slightly hard, very friable; calcareous; moderately alkaline.

The A1 horizon is typically 4 inches thick but ranges from 3 to 7 inches in thickness. Depth to lime ranges from 18 to 36 inches.

DwC—Dwyer loamy sand, 3 to 12 percent slopes. This soil is gently sloping to rolling and is on terraces and mesas. It has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of Palma soils and minor areas of Rock outcrop.

Runoff is slow. The hazard of soil blowing is high, and the hazard of water erosion is slight.

This soil is used mostly for grazing and as wildlife habitat. (fig. 1). Capability unit VIe–2; Sandy Foothills range site.

Fruita Series

The Fruita series consists of deep, well-drained soils. These soils formed in sediment that weathered from sedimentary rock. They are on fans and benches. The slope is 3 to 8 percent, and elevation is 4,800 to 5,400 feet. The natural vegetation is mainly saltbush, rabbitbrush, galleta, and Indian ricegrass. The average annual precipitation is 9 inches. The mean annual temperature is 53° F., and the frost-free season is 150 to 175 days.

In a representative profile the surface layer is brown loam about 5 inches thick. The subsoil is brown clay loam about 9 inches thick. The substratum is pinkish-gray loam about 12 inches thick. It is underlain by pinkish-gray clay loam that extends to a depth of 60 inches.

Fruita soils have moderate permeability and a high available water capacity. They are mildly alkaline in the surface layer and in the upper part of the subsoil; below that they are moderately alkaline. Roots can penetrate to a depth of more than 60 inches.

These soils are used for grazing, crops, and as wildlife habitat.

Representative profile of Fruita loam, in an area of Fruita-Avalon association, undulating, SW¼ sec. 32, T. 8 S., R. 102 W., in an area of grass.

A1—0 to 5 inches, brown (10YR 5/3) loam, dark brown (10YR 4/3) when moist; weak, thin, platy breaking to weak, fine, granular structure; slightly hard, very friable; mildly alkaline; clear, smooth boundary.

B2t—5 to 14 inches, brown (7.5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; weak, fine, prismatic parting to moderate, fine, subangular blocky structure; hard, friable; calcareous in the lower part; thin patchy films of clay; mildly alkaline; gradual, smooth boundary.

C1ca—14 to 26 inches, pinkish-gray (7.5YR 6/2) loam, brown (7.5YR 5/4) when moist; massive; hard, slightly sticky; calcareous; moderately alkaline; 50 percent pinkish-white (7.5YR 8/2) nodules of lime; clear, wavy boundary.

C2ca—26 to 60 inches, pinkish-gray (7.5YR 6/2) clay loam, brown (7.5YR 5/4) when moist; massive; hard, sticky; calcareous; moderately alkaline; 10 to 30 percent pinkish-white (7.5YR 8/2) nodules of lime; 20 percent sandstone chips, coarse gravel, and cobbles that increase with depth.

The A horizon is sandy loam or loam. The B2t horizon is loam or clay loam. Coarse fragments make up as much as 20 percent, by volume, of the soil.

FaC—Fruita-Avalon association, undulating. This association consists of about 50 percent Fruita loam and 35 percent Avalon loam. The Fruita soil has the profile described as representative of the series. Fruita soils are on fans and benches that have a slope of 3 to 8

Figure 1.—**Typical landscape in an area of Dwyer loamy sand, 3 to 12 percent slopes.**

percent. Avalon soils are on bench edges and ridgetops that have a slope of 6 to 12 percent.

Included with this association in mapping are Chipeta and Persayo soils. Also included is a soil that is similar to Fruita soil, but it has a subsoil of heavy clay loam or clay.

Runoff is moderate, and the hazard of erosion is moderate to high.

This association is used mainly for grazing. Capability unit VIe–1; Loamy Salt Desert range site.

Gateway Series

The Gateway series consists of moderately deep, well-drained soils. These soils formed in residuum from shale on hills and mountain sides. The slope is 2 to 60 percent, and elevation is 8,000 to 9,500 feet. The natural vegetation is mainly spruce, fir, aspen, and grasses of the subalpine zone. The average annual precipitation is 20 inches. The mean annual temperature is 40° F., and the frost-free season is 35 to 50 days.

In a representative profile, beneath a 5-inch layer of organic material, the surface layer is light brownish-gray loam about 10 inches thick. The next layer is light brownish-gray silty clay loam about 5 inches thick. The subsoil is yellowish-brown silty clay about 15 inches thick. It is underlain by noncalcareous shale and soft sandstone at a depth of about 30 inches.

Gateway soils have slow permeability and a low or moderate available water capacity. They are slightly acid. Roots can penetrate to a depth of 20 to 40 inches.

These soils are used for timber, grazing, and watershed.

Representative profile of Gateway loam, in an area of Gateway-Cebone-Bangston association, NE¼ sec. 8, T. 14 S., R. 10 W., in an area of timber.

O1—5 inches to 1 inch, undecomposed organic material, mainly bark, twigs, needles, and grass.

O2—1 inch to 0, partly decomposed organic material.

A2—0 to 10 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak, medium, platy parting to weak, fine, granular structure; vesicular; soft, very friable; slightly acid; gradual, wavy boundary.

A&B—10 to 15 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; common, yellowish-brown (10YR 5/4) nodules and seams of more clayey material, dark yellowish brown (10YR 4/4) when moist; weak, medium, subangular blocky structure; very hard, friable; few films of clay on peds and in

some root channels; slightly acid; gradual, wavy boundary.

B2t—15 to 30 inches, yellowish-brown (10YR 5/4) silty clay, dark yellowish brown (10YR 4/4) when moist; weak, medium, prismatic parting to moderate, medium, angular blocky structure; extremely hard, very plastic; thin continuous films of clay on faces of peds and in root channels; slightly acid; clear, wavy boundary.

IIC—30 to 40 inches, noncalcareous shale and interbedded soft sandstone.

The A2 horizon is loam or very fine sandy loam. Depth to sandstone bedrock ranges from 20 to 40 inches.

GcE—Gateway-Cebone-Bangston association, steep. This association consists of about 35 percent Gateway loam, 30 percent Cebone loam, and 25 percent Bangston sandy loam. These soils are on mountainsides and ridges. The slope is 2 to 40 percent. Each soil has the profile described as representative of its series.

Included with this association in mapping are areas of Rock outcrop and Mayflower soils.

Runoff is moderate to rapid. The hazard of erosion is moderate to high.

This association is mostly in woodland. Areas that have been burned or logged are covered by aspen trees and have a good, grazable understory of grasses, shrubs, and forbs. Southern and eastern exposures are commonly covered by ponderosa pine. Northern and western exposures are covered by Douglas-fir, subalpine fir, and Englemann spruce. The site index, or the average height of dominant and codominant trees at 100 years, is 57 to 70 feet for ponderosa pine and 70 to 80 for Englemann spruce and subalpine fir. These soils are moderately well suited to growing trees for timber. They are used for grazing, watershed, recreation, and as wildlife habitat. Growing Christmas trees in areas of Douglas-fir, subalpine fir, and spruce is an alternative use for these soils. Capability unit VIe–3; not placed in a range site.

GcF—Gateway-Cebone-Bangston association, very steep. This association consists of about 35 percent Gateway loam, 30 percent Cebone loam, and 25 percent Bangston sandy loam. The slope is 40 to 60 percent. These soils are on mountain sides and ridges.

Included with this association in mapping are minor areas of Rock outcrop and Skyway soils.

Runoff is rapid, and the hazard of water erosion is very high.

This association is in woodland. Fairly large areas that have been burned or logged are in aspen, southern and eastern exposures are mainly ponderosa pine and aspen, and northern and western exposures are mainly Englemann spruce and subalpine fir. Capability unit VIIe–2; not placed in a range site.

Gibbler Series

The Gibbler series consists of moderately deep, well-drained soils. These soils formed in eolian deposits weathered from sandstone on upland hills and ridges. The slope is 3 to 12 percent, and elevation is 6,500 to 7,500 feet. The natural vegetation is mainly sagebrush, rabbitbrush, wheatgrass, and bluegrass. The average annual precipitation is 16 inches. The mean annual temperature is 50° F., and the frost-free season is 100 to 125 days.

In a representative profile the surface layer is light reddish-brown fine sandy loam about 4 inches thick. The subsurface layer is pink, light fine sandy loam about 2 inches thick. The subsoil is reddish-brown clay and pink channery clay loam about 20 inches thick. Bedrock is at a depth of about 26 inches.

Gibbler soils have slow permeability and a low available water capacity. They are neutral in the upper 20 inches and moderately alkaline in the lower 6 inches. Roots can penetrate to a depth of 20 to 40 inches.

These soils are used for grazing, as wildlife habitat, and for watershed.

Representative profile of Gibbler fine sandy loam, in an area of Gibbler-Witt association, undulating, SW¼ sec. 7, T. 49 S., R. 17 W., in an area of grass.

A1—0 to 4 inches, light reddish-brown (5YR 6/4) fine sandy loam, reddish brown (5YR 4/4) when moist; moderate, very fine, granular structure; soft, very friable; neutral; clear, smooth boundary.

A2—4 to 6 inches, pink (5YR 7/3) light fine sandy loam, reddish brown (5YR 5/3) when moist; moderate, thin, platy parting to strong, fine, granular structure; soft, very friable; neutral; abrupt, smooth boundary.

B2t—6 to 20 inches, reddish-brown (5YR 5/4) clay, reddish brown (5YR 4/4) when moist; strong, fine, prismatic parting to strong, fine, angular blocky structure; extremely hard, very sticky and very plastic; thin continuous films of clay on faces of peds and in root channels; neutral; clear, wavy boundary.

B3ca—20 to 26 inches, pink (5YR 8/4) channery heavy clay loam, light reddish brown (5YR 6/4) when moist; weak, medium, angular blocky structure; extremely hard, very sticky and very plastic; 15 percent fragments of sandstone; few thin films of clay on peds and in some root channels; some thin seams and concretions of calcium carbonate; moderately alkaline; abrupt, wavy boundary.

R—26 inches, hard sandstone bedrock.

Sandstone fragments make up as much as 15 percent of the soil. Depth to bedrock ranges from 20 to 40 inches.

GeC—Gibbler-Witt association, undulating. This association is on upland hills and ridges. It consists of about 50 percent Gibbler fine sandy loam and about 40 percent Witt fine sandy loam. The slope is about 3 to 12 percent. Each soil has the profile described as representative of its series.

Included with this association in mapping are small areas of Potts and Palma soils.

Runoff is moderate. The hazard of erosion is moderate.

This association is used mainly for grazing and as wildlife habitat. Capability unit VIe–2; Loamy Foothills range site.

Glenberg Series

The Glenberg series consists of deep, well-drained soils. These soils formed in alluvium on flood plains and fans. The slope is 0 to 8 percent, and elevation is 5,800 to 7,000 feet. The natural vegetation is mainly sagebrush, rabbitbrush, wheatgrass, and bluegrass. The average annual precipitation is 16 inches. The mean annual temperature is 50° F., and the frost-free season is 100 to 125 days.

In a representative profile the surface layer is brown sandy loam about 5 inches thick. The underlying layer

is brown sandy loam that extends to a depth of 60 inches or more.

Glenberg soils have rapid permeability and low or moderate available water capacity. They are moderately alkaline. Roots can penetrate to a depth of more than 60 inches.

These soils are used for grazing, crops, and as wildlife habitat.

Representative profile of Glenberg sandy loam, 0 to 3 percent slopes, NW¼ sec. 18, T. 12 S., R. 102 W., in an area of grass.

A1—0 to 5 inches, brown (7.5YR 5/2) sandy loam, dark brown (7.5YR 3/2) when moist; weak, fine, granular structure; slightly hard, very friable; calcareous; moderately alkaline; clear, wavy boundary.

C—5 to 60 inches, brown (7.5YR 5/4) sandy loam, dark brown (7.5YR 4/2) when moist; massive; slightly hard, friable; calcareous; moderately alkaline; thin lenses of dark-brown (7.5YR 3/2) loam and loamy sand in this layer.

The A1 horizon is fine sandy loam or sandy loam. The C horizon is sandy loam that is commonly stratified with lenses of loam or light clay loam.

GlA—Glenberg sandy loam, 0 to 3 percent slopes. This soil is nearly level and is on flood plains. It has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of soils that have a surface layer of loamy sand and some Palma soils.

Runoff is slow. The hazard of erosion is high. A few areas have active gully erosion. The soil is subject to flooding.

This soil is used mainly for grazing and as wildlife habitat. Small areas are irrigated for alfalfa, pasture, barley, and oats. Capability unit IIe–1 (irrigated), VIe–2 (nonirrigated); Sandy Foothills range site.

GlB—Glenberg sandy loam, 3 to 8 percent slopes. This soil is gently sloping and is on fans.

Included with this soil in mapping are a few small areas of Potts and Palma soils.

Runoff is moderate. The hazard of erosion is high. A few areas have active gully erosion. The soil is subject to flooding.

This soil is used for grazing and as wildlife habitat. Capability unit VIe–2; Sandy Foothills range site.

Gullied Land

Gu—Gullied land. This land type consists of stratified loamy, sandy and clayey material on terraces and fans of intermittent drainageways. The areas are dissected by many gullies 5 to 50 feet deep. Parts of these nearly level to gently sloping areas have a sparse cover of grasses and brush. Most of the precipitation in these areas carries much sediment as it runs off. Capability unit VIIIe–1; not placed in a range site.

Ildefonso Series

The Ildefonso series consists of deep, well-drained soils. These soils formed in cobbly and gravelly alluvial sediment on fans. The slope is 3 to 12 percent, and elevation is 5,200 to 5,600 feet. The natural vegetation is mainly saltbush, rabbitbrush, galleta, and Indian ricegrass. The average annual precipitation is 11 inches. The mean annual temperature is 52° F., and the frost-free season is 140 to 165 days.

In a representative profile the surface layer is brown cobbly sandy loam about 5 inches thick. The underlying layers are light-brown cobbly sandy loam and pinkish-white very cobbly sandy loam that extend to a depth of 60 inches or more.

Ildefonso soils have rapid permeability and a low available water capacity. They are mildly alkaline or moderately alkaline. Roots can penetrate to a depth of more than 60 inches.

These soils are used for grazing, as wildlife habitat, and for watershed.

Representative profile of Ildefonso cobbly sandy loam, 3 to 12 percent slopes, SW¼ sec. 25, T. 12 S., R. 98 W., in an area of grass.

A1—0 to 5 inches, brown (7.5YR 5/2) cobbly sandy loam, dark brown (7.5YR 4/2) when moist; moderate, medium and fine, granular structure; soft, very friable; calcareous; mildly alkaline; 20 to 30 percent basalt cobbles; clear, smooth boundary.

AC—5 to 14 inches, light-brown (7.5YR 6/4) cobbly sandy loam, brown (7.5YR 4/4) when moist; weak, medium, subangular blocky parting to weak, medium, granular structure; slightly hard, friable; calcareous; moderately alkaline; 20 to 30 percent basalt cobbles that have moderate coatings of lime on undersides; gradual, smooth boundary.

Cca—14 to 60 inches, pinkish-white (7.5YR 8/2) very cobbly sandy loam, light brown (7.5YR 6/3) when moist; massive; hard, friable; calcareous; moderately alkaline; visible lime in seams, streaks, and in concretions around stones; 40 to 60 percent basalt cobbles; gradual, smooth boundary.

Cobbles and stones make up 25 to 40 percent of the upper 3 feet of the soil and 40 to 60 percent of the material below that.

IdC—Ildefonso cobbly sandy loam, 3 to 12 percent slopes. This soil is gently sloping to rolling and is on alluvial fans. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Utaline and Scholle soils.

Runoff is moderate. The hazard of water erosion is moderate.

The soil is used mainly for grazing and as wildlife habitat. Capability unit VIIe–1; Stony Salt Desert range site.

Lazear Series

The Lazear series consists of shallow, well-drained soils. These soils formed in sandstone and sandy shale on hillcrests and ridges. The slope is 3 to 30 percent, and elevation is 5,000 to 6,000 feet. The natural vegetation is mainly saltbush, rabbitbrush, galleta, and Indian ricegrass. The average annual precipitation is 12 inches. The mean annual temperature is 52° F., and the frost-free season is 160 to 175 days.

In a representative profile the surface layer is light brownish-gray gravelly loam about 4 inches thick. The underlying layer is light-brown gravelly loam about 10 inches thick over hard, calcareous, sandstone bedrock.

Lazear soils have moderate permeability and a low available water capacity. They are moderately alkaline. Roots can penetrate to a depth of 8 to 15 inches.

These soils are used for grazing, as wildlife habitat, and watershed areas.

Representative profile of Lazear gravelly loam, in an area of Lazear-Rock outcrop complex, 3 to 30 percent slopes, NW¼ sec. 32, T. 9 S., R. 103 W., in an area of grass.

A1—0 to 4 inches, light brownish-gray (10YR 6/2) gravelly loam, dark grayish brown (10YR 4/2) when moist; moderate, fine, granular structure; soft, very friable; 15 percent small fragments of sandstone; calcareous; moderately alkaline; clear, smooth boundary.

C—4 to 14 inches, light-brown (7.5YR 6/3) gravelly loam, dark brown (7.5YR 4/3) when moist; massive; slightly hard, very friable; 20 percent small fragments of sandstone; calcareous; moderately alkaline; abrupt, wavy boundary.

R—14 inches, hard calcareous sandstone bedrock.

The A horizon is gravelly sandy loam or gravelly loam. The depth to bedrock ranges from 8 to 15 inches.

LkE—Lazear-Rock outcrop complex, 3 to 30 percent slopes. This complex is made up of shallow, gently sloping to steep Lazear soils and areas of Rock outcrop on hillcrests and ridges. It consists of about 60 percent Lazear gravelly loam and 35 percent Rock outcrop. The Lazear soil has the profile described as representative of the series.

Included with this complex in mapping are small areas of Nelman soils.

Runoff is rapid, and the hazard of water erosion is high.

This complex is used mostly for grazing and as wildlife habitat. Lazear soil is in capability unit VIIe–1 and in Loamy Salt Desert range site; Rock outcrop was not placed in a capability group or in a range site.

Loma Series

The Loma series consists of deep, well-drained soils. These soils formed in eolian deposits from redbed formations on mesas. The slope is 0 to 3 percent, and elevation is 6,500 to 7,500 feet. The natural vegetation is mainly sagebrush, rabbitbrush, wheatgrass, and bluegrass. The annual precipitation is about 16 inches. The mean annual temperature is 50° F., and the frost-free season is 100 to 125 days.

In a representative profile the surface layer is brown loam about 5 inches thick. The subsoil is brown silty clay loam, reddish-gray silty clay, and reddish-brown clay loam about 23 inches thick. It is underlain by light reddish-brown silt loam that extends to a depth of 40 inches or more.

Loma soils have slow permeability and a high available water capacity. They are moderately alkaline. Roots can penetrate to a depth of 40 inches or more.

These soils are used for grazing, as wildlife habitat, and watershed areas.

Representative profile of Loma loam, NE¼ sec. 24, T. 12 S., R. 102 W., in an area of grass.

A1—0 to 5 inches, brown (7.5YR 5/3) loam, dark brown (7.5YR 3/3) when moist; strong, fine, granular structure; soft, very friable; calcareous; moderately alkaline; clear, smooth boundary.

B1—5 to 9 inches, brown (7.5YR 5/2) heavy silty clay loam, dark brown (7.5YR 3/2) when moist; strong, fine, subangular blocky parting to medium, granular structure; hard, very friable; few films of clay on peds; calcareous; moderately alkaline; clear, smooth boundary.

B21t—9 to 14 inches, reddish-gray (5YR 5/2) light silty clay, dark reddish brown (5YR 3/2) when moist; moderate, medium, prismatic parting to moderate, fine, blocky structure; extremely hard, friable; thin, nearly continuous films of clay on peds and in root channels and pores; calcareous; moderately alkaline; clear, smooth boundary.

B22t—14 to 21 inches, reddish-gray (5YR 5/2) light silty clay, dark, reddish gray (5YR 4/2) when moist; strong, medium, prismatic parting to strong, medium, blocky structure; extremely hard, friable; thin, continuous films of clay on peds and in root channels and pores; calcareous; moderately alkaline; gradual, wavy boundary.

B3ca—21 to 28 inches, reddish-brown (5YR 5/3) heavy clay loam, reddish brown (5YR 4/3) when moist; weak, medium, prismatic parting to moderate, medium, subangular and blocky structure; hard, friable; thin films of clay on peds and in root channels; some visible concretions or thin seams and streaks of secondary calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

Cca—28 to 40 inches, light reddish-brown (5YR 6/3) silt loam, reddish brown (5YR 5/3) when moist; massive; hard, very friable; some visible concretions or thin seams and streaks of secondary calcium carbonate; calcareous; moderately alkaline.

The fragments of sandstone make up as much as 15 percent, by volume, of the soil.

Lo—Loma loam. This soil is nearly level and is on mesa tops. It has the profile described as representative of the series. Included with this soil in mapping are small areas of Potts and Dominguez soils.

Runoff is slow. The hazard of soil blowing is slight, and that of water erosion is moderate. Gully erosion is active in some small areas.

This soil is used mostly for grazing and as wildlife habitat. It is well suited to livestock ponds or small reservoirs. Capability unit VIe–2; Loamy Foothills range site.

Mayflower Series

The Mayflower series consists of moderately deep, well-drained soils that formed in residuum from shale and sandy shale on upland hills and ridges. The slope is 5 to 40 percent, and elevation is 8,000 to 9,500 feet. The natural vegetation includes such grasses as Thurbers fescue, Columbia needlegrass, native bluegrass, and such shrubs as big sagebrush, silver sagebrush, snowberry, and cinquefoil. The average annual precipitation is 20 inches. The mean annual temperature is 38° F., and the frost-free season is 35 to 50 days.

In a representative profile the surface layer is reddish gray and reddish-brown silty clay that extends to interbedded shale and sandstone at a depth of about 32 inches.

Mayflower soils have slow permeability and a moderate available water capacity. They are neutral in the upper 26 inches and moderately alkaline in the lowermost 6 inches.

These soils are used for grazing, as wildlife habitat, and for watershed.

Representative profile of Mayflower silt loam, in an area of Mayflower-Skyway association, rolling, SE¼ sec. 25, T. 14 S., R. 102 W., in an area of grass.

A1—0 to 4 inches, dark-gray (10YR 4/1) silt loam, black

(10YR 2/1) when moist; strong, fine, granular structure; soft, very friable; neutral; clear, smooth boundary.

B1—4 to 8 inches, dark-gray (10YR 4/1) heavy silt loam, black (10YR 2/1) when moist; moderate, fine, subangular structure; soft, very friable; neutral; clear, smooth boundary.

B21t—8 to 20 inches, reddish-gray (5YR 5/2) light silty clay, dark reddish brown (5YR 3/2) when moist; moderate, medium, prismatic parting to strong, fine, blocky structure; extremely hard, very plastic; thin continuous films of clay on peds and in root channels and pores; neutral; clear, smooth boundary.

B22t—20 to 26 inches, reddish-brown (5YR 5/3) light silty clay, reddish brown (5YR 4/3) when moist; moderate, coarse, prismatic parting to moderate, coarse, blocky structure; extremely hard, very plastic; thin continuous films of clay on peds and in root channels and pores; few slickensides; neutral; gradual, wavy boundary.

B3—26 to 32 inches, reddish-brown (5YR 5/3) light silty clay, reddish brown (5YR 4/3) when moist; weak, very coarse, prismatic parting to weak, very coarse, blocky structure; extremely hard, very plastic; few thin films of clay on peds and in root channels; many olive, gray, or dark reddish-brown chips of shale; calcareous; moderately alkaline; diffuse, wavy boundary.

IIc—32 to 60 inches, red and olive Morrison shale and interbedded sandstone.

Depth to shale ranges from 20 to 40 inches. Coarse fragments make up as much as 15 percent, by volume, of the soil but generally less than 5 percent.

MkD—Mayflower-Skyway association, rolling. This association is gently sloping to steep and is on upland hills and ridges. It consists of about 60 percent Mayflower silt loam and about 30 percent Skyway fine sandy loam. The slope ranges from 5 to 40 percent. Each soil has the profile described as representative of that series.

Included with this association in mapping are minor areas of Cebone and Gateway soils.

Runoff is moderate to rapid. The hazard of erosion is moderate to high.

This association is used mainly for grazing and as wildlife habitat. Capability unit VIe–2; Subalpine Loam range site.

Miracle Series

The Miracle series consists of moderately deep, well-drained soils. These soils formed in residuum from sandstone on upland hills and mesas. The slope is 3 to 30 percent, and elevation is 7,500 to 8,700 feet. The natural vegetation is mainly big sagebrush, rabbitbrush, wheatgrass, bluegrass, and needlegrass. The average annual precipitation is 20 inches. The mean annual temperature is 40° F., and the frost-free season is 35 to 60 days.

In a representative profile the surface layer is brown fine sandy loam about 4 inches thick. The subsoil is brown or reddish-brown sandy clay loam about 26 inches thick. It is underlain by hard reddish-brown sandstone.

Miracle soils have moderate permeability and low available water capacity. They are neutral. Roots can penetrate to a depth of 20 to 40 inches.

These soils are used for grazing, as wildlife habitat, and for watershed.

Representative profile of Miracle fine sandy loam in an area of Miracle-Splitro association, undulating, SW¼ sec. 24, T. 13 S., R. 104 W., in an area of grass.

A1—0 to 4 inches, brown (7.5YR 5/2) fine sandy loam, very dark brown (7.5YR 2/2) when moist; strong, very fine, granular structure; soft, very friable; neutral; clear, smooth boundary.

B1—4 to 8 inches, brown (7.5YR 5/2) light sandy clay loam, very dark brown (7.5YR 2/2) when moist; moderate, fine, subangular blocky parting to moderate, medium, granular structure; slightly hard, very friable; few thin films of clay on peds; neutral; clear, smooth boundary.

B2t—8 to 30 inches, reddish-brown (5YR 5/3) sandy clay loam, reddish brown (5YR 4/4) when moist; moderate, fine, prismatic parting to strong, fine, blocky structure; very hard, very friable; moderately thick, continuous films of clay on peds and in root channels and pores; neutral; gradual, wavy boundary.

R—30 inches, hard, noncalcareous, reddish-brown sandstone.

The A1 horizon is fine sandy loam or loam. The B2t horizon is sandy clay loam or light clay loam. Depth to bedrock ranges from 20 to 40 inches.

MpC—Miracle-Splitro association, undulating. This association consists of about 50 percent Miracle fine sandy loam and 40 percent Splitro sandy loam. Each soil has the profile described as representative of its series. Miracle soils are on mesas and benches and have a slope of about 3 to 12 percent. Splitro soils are on mesa and bench edges and have a slope of 6 to 12 percent.

Included with this association in mapping are minor areas of Owen Creek soils and Rock outcrop.

Runoff is medium. The hazard of erosion is moderate to high.

This association is used for range. Capability unit VIe–2; Mountain Loam range site.

Nelman Series

The Nelman series consists of moderately deep, well-drained soils. These soils formed in residuum from sandstone on upland hills and ridges. The slope is 3 to 12 percent, and elevation is 4,800 to 5,800 feet. The natural vegetation is mainly saltbush, rabbitbrush, galleta, and Indian ricegrass. The average annual precipitation is 12 inches. The mean annual temperature is 52° F., and the frost-free season is 125 to 165 days.

In a representative profile the surface layer is pinkish-gray sandy loam about 6 inches thick. The underlying layer is light-brown or pink fine sandy loam about 20 inches thick over hard calcareous sandstone.

Nelman soils have rapid permeability and a low available water capacity. They are moderately alkaline. Roots can penetrate to a depth of 20 to 40 inches.

These soils are used for grazing, as wildlife habitat, and for watershed.

Representative profile of Nelman sandy loam, 3 to 12 percent slopes, SE¼ sec. 8, T. 3 S., R. 2 E., in an area of grass.

A1—0 to 6 inches, pinkish-gray (7.5YR 6/2) sandy loam, dark brown (7.5YR 4/2) when moist; moderate, fine, granular structure; soft, very friable; 5 percent fragments of sandstone; calcareous; moderately alkaline; clear, smooth boundary.

AC—6 to 10 inches, light brown (7.5YR 6/3) fine sandy loam, dark brown (7.5YR 4/3) when moist; weak, medium, subangular blocky parting to moderate,

fine, granular structure; slightly hard, very friable; 10 percent fragments of sandstone; calcareous; moderately alkaline; gradual, wavy boundary.

C—10 to 26 inches, pink (7.5YR 7/4) fine sandy loam, light brown (7.5YR 6/4) when moist; massive; slightly hard, very friable; 10 percent fragments of sandstone; few soft masses of secondary carbonates; calcareous; moderately alkaline; abrupt, wavy boundary.

R—26 inches, hard calcareous sandstone.

Depth to bedrock ranges from 20 to 40 inches. The A1 horizon is sandy loam or fine sandy loam.

NeC—Nelman sandy loam, 3 to 12 percent slopes. This soil is gently sloping to rolling and is on upland hills and ridges. It has the profile described as representative of the series.

Included with this soil in mapping are minor areas of Lazear soils and a few areas of Rock outcrop.

Runoff is rapid. The hazard of erosion is high.

This soil is used mainly for grazing and as wildlife habitat. Capability unit VIe–1; Loamy Salt Desert range site.

NlC—Nelman-Lazear sandy loams, 3 to 12 percent slopes. This complex is made up of gently sloping to rolling soils on upland hills and ridges. It consists of about 60 percent Nelman sandy loam and about 30 percent Lazear sandy loam. The Nelman soil has the profile described as representative of the series. The Lazear soil has a profile similar to the one described as representative of the series, but the surface layer is sandy loam.

Included with this complex in mapping are areas of Rock outcrop.

Runoff is rapid. The hazard of erosion is high.

These soils are used mainly for grazing and as wildlife habitat. Capability unit VIe–1; Loamy Salt Desert range site.

Owen Creek Series

The Owen Creek series consists of moderately deep, well-drained soils. These soils formed in residuum from shale on mountain sides and ridges. The slope is 3 to 30 percent, and elevation is 7,500 to 8,700 feet. The natural vegetation is mainly sagebrush, rabbitbrush, wheatgrass, and bluegrass. The average annual precipitation is 20 inches. The mean annual temperature is 40° F., and the frost-free season is 35 to 60 days.

In a representative profile the surface layer is dark grayish-brown fine sandy loam about 15 inches thick. The subsoil is brown sandy clay loam about 6 inches thick. The substratum is brown heavy clay loam about 9 inches thick over sandy shale and sandstone bedrock.

Owen Creek soils have slow permeability at a depth of about 30 inches and a low or moderate available water capacity. They are neutral in the upper 21 inches and mildly alkaline in the lowermost 9 inches. Roots can penetrate to a depth of 20 to 40 inches.

These soils are used for grazing, as wildlife habitat, and for watershed.

Representative profile of Owen Creek sandy loam, in an area of Owen Creek-Miracle complex, 3 to 12 percent slopes, NW¼ sec. 17, T. 13 S., R. 101 W., in an area of range.

A11—0 to 15 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, granular parting to moderate, fine, granular structure; slightly hard, very friable; neutral; many fine roots; clear, smooth boundary.

B2t—15 to 21 inches, brown (7.5YR 4/4) heavy sandy clay loam, dark brown (7.5YR 4/4) when moist; moderate, medium, prismatic parting to moderate, medium, subangular blocky structure; hard, friable; thin continuous films of clay on peds; neutral; gradual, wavy boundary.

C—21 to 30 inches, brown (7.5YR 5/3) heavy clay loam or light clay, dark brown (7.5YR 4/4) when moist; massive; very hard, firm; calcareous in spots; mildly alkaline; clear, wavy boundary.

R—30 inches, sandstone and sandy shale.

Depth to bedrock ranges from 20 to 40 inches. Fragments of sandstone make up 5 to 20 percent, by volume, of the soil. The B2t horizon is sandy clay loam or light clay.

OcC—Owen Creek-Miracle complex, 3 to 12 percent slopes. This complex is made up of gently sloping to rolling soils on mountains and ridges. It consists of about 60 percent Owen Creek fine sandy loam and about 30 percent Miracle fine sandy loam. Each soil has the profile described as representative of its series.

Included with this complex in mapping are small areas of Splitro soils and a few areas of Rock outcrop.

Runoff is moderate. The hazard of erosion is moderate.

This complex is used mainly for grazing and as wildlife habitat. Capability unit VIe–2; Mountain Loam range site.

OcE—Owen Creek-Miracle complex, 12 to 30 percent slopes. This complex is made up of rolling to steep soils on mountain sides and ridges. It consists of about 60 percent Owen Creek fine sandy loam and about 30 percent Miracle fine sandy loam. The Owen Creek soil has a profile similar to the one described as representative of the series, but in some areas it has a surface layer of clay loam.

Included with this complex in mapping are small areas of Splitro soils and Rock outcrop.

Runoff is rapid. The hazard of erosion is high.

This complex is used mainly for grazing and as wildlife habitat. Capability unit VIe–2; Mountain Loam range site.

Palma Series

The Palma series consists of deep, well-drained soils. These soils formed in sandy eolian deposits on uplands. The slope is 3 to 12 percent, and elevation is 6,800 to 7,500 feet. The natural vegetation is mainly sagebrush, rabbitbrush, wheatgrass, and bluegrass. The average annual precipitation is 16 inches. The mean annual temperature is 50° F., and the frost-free season is 100 to 125 days.

In a representative profile the surface layer is reddish-brown sandy loam about 4 inches thick. The subsoil is reddish-brown or light reddish-brown fine sandy loam about 24 inches thick. Below this is pink or yellowish-red sandy loam that extends to a depth of 60 inches or more.

Palma soils have moderately rapid permeability and a moderate available water capacity. They are mildly alkaline in the upper 20 inches and moderately alkaline in the lowermost 40 inches. Roots can penetrate to a depth of more than 60 inches.

These soils are used for grazing, crops, and as wildlife habitat.

Representative profile of Palma sandy loam, 3 to 12 percent slopes, NW¼ sec. 20, T. 12 S., R. 103 W., in an area of grass.

A1—0 to 4 inches, reddish-brown (5YR 5/3) sandy loam, dark reddish brown (5YR 3/3) when moist; weak, very thin, platy parting to weak, fine, granular structure; soft, very friable; mildly alkaline; clear, smooth boundary.

B1—4 to 10 inches, reddish-brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) when moist; weak, medium, subangular blocky structure; slightly hard, very friable; thin patchy films of clay; mildly alkaline; clear, smooth boundary.

B2t—10 to 20 inches, reddish-brown (5YR 5/4) fine sandy loam; reddish brown (5YR 4/4) when moist; moderate, medium, subangular blocky structure; hard, friable; thin nearly continuous films of clay on peds; mildly alkaline; gradual, smooth boundary.

B3—20 to 28 inches, light reddish-brown (5YR 6/4) fine sandy loam, reddish brown (5YR 5/4) when moist; weak, medium, subangular blocky structure; hard, friable; thin patchy films of clay; calcareous; moderately alkaline; gradual, smooth boundary.

C1ca—28 to 40 inches, pink (5YR 7/4) sandy loam, light reddish brown (7.5YR 6/6) when moist; massive; hard, friable; calcareous; moderately alkaline; much visible lime; gradual, wavy boundary.

C2—40 to 60 inches, yellowish-red (5YR 4/6) sandy loam; yellowish red (5YR 4/6) when moist; massive; slightly hard, friable; calcareous; moderately alkaline.

The A horizon is fine sandy loam or sandy loam that has hue of 5YR or 7.5YR. The B2t horizon has hue of 2.5YR to 7.5YR.

PaC—Palma sandy loam, 3 to 12 percent slopes. This soil is gently sloping to rolling and is on uplands and mesas. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Potts and Batterson soils.

Runoff is moderate, and the hazard of water erosion is moderate.

This soil is used mainly for grazing by wildlife. A few small areas are irrigated, mainly areas in alfalfa or pasture. Capability unit IVe–1 (irrigated), VIe–2 (nonirrigated); Loamy Foothills range site.

Persayo Series

The Persayo series consists of shallow, well-drained soils. These soils formed in residuum that weathered from shale on upland hills and ridges. The slope is 3 to 25 percent, and elevation is 4,800 to 5,600 feet. The natural vegetation is mainly saltbush, rabbitbrush, galleta, and Indian ricegrass. The average annual precipitation is 9 inches. The mean annual temperature is 52° F., and the frost-free season is 140 to 165 days.

In a representative profile the surface layer is pale-yellow silt loam about 5 inches thick. The underlying layer is light brownish-gray silt loam that extends to yellowish-brown shale at a depth of about 16 inches.

Persayo soils have moderately slow permeability and a low available water capacity. They are moderately alkaline. Roots can penetrate to a depth of about 10 to 20 inches.

These soils are used for grazing, as wildlife habitat, and for watershed.

Representative profile of Persayo silt loam, 3 to 25 percent slopes, NE¼ sec. 12, T. 9 S., R. 103 W., in an area of grass.

A1—0 to 5 inches, pale-yellow (2.5YR 7/4) silt loam, light olive brown (2.5Y 5/4) when moist; first inch is vesicular; weak, fine, subangular blocky parting to weak, fine, granular structure; soft, very friable; calcareous; moderately alkaline; small, flat chips of sandstone common on surface; clear, smooth boundary.

C1—5 to 16 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; hard, firm; calcareous; moderately alkaline; many chips of shale and crystals of gypsum in lowermost 4 inches; clear, smooth boundary.

C2—16 inches, yellowish-brown silty shale.

The A1 horizon is silt loam or silty clay loam. Depth to shale ranges from 10 to 20 inches. Chips of sandstone and shale make up 5 to 15 percent, by volume, of the soil.

PeD—Persayo silt loam, 3 to 25 percent slopes. This soil is gently sloping to steep and is on upland hills and ridges. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Chipeta soils and Badland.

Runoff is rapid. The hazard of erosion is high.

This soil is used mainly for grazing and as wildlife habitat. Capability unit VIIe–1; Silty Salt Desert range site.

Potts Series

The Potts series consists of deep, well-drained soils. These soils formed in eolian deposits on upland hills and ridges. The slope is 3 to 12 percent, and elevation is 6,500 to 7,500 feet. The natural vegetation is mainly sagebrush, rabbitbrush, and wheatgrass. The average annual precipitation is 16 inches. The mean annual temperature is 50° F., and the frost-free season is 100 to 125 days.

In a representative profile the surface layer is reddish-brown sandy loam about 4 inches thick. The subsoil is reddish-brown loam or clay loam and light reddish-brown loam about 20 inches thick. The substratum is light reddish-brown loam that extends to a depth of 60 inches or more.

Potts soils have moderate permeability and a high available water capacity. They are neutral in the upper 16 inches and mildly alkaline or moderately alkaline in the lowermost 44 inches. Roots can penetrate to a depth of more than 60 inches.

These soils are used for grazing, as wildlife habitat, and for watershed.

Representative profile of Potts sandy loam, 3 to 12 percent slopes, NE¼SW¼ sec. 5, T. 13 S., R. 103 W., in an area of grass.

A1—0 to 4 inches, reddish-brown (5YR 4/4) sandy loam, dark reddish brown (5YR 3/4) when moist; weak or moderate, fine, granular structure; soft, very friable; neutral; clear, smooth boundary.

B1—4 to 8 inches, reddish-brown (5YR 4/4) loam, dark reddish brown (5YR 3/4) when moist; weak, medium, subangular blocky structure; slightly hard, very friable; neutral; clear, smooth boundary.

B21t—8 to 16 inches, reddish-brown (5YR 4/3) light clay loam, dark reddish brown (5YR 4/4) when moist; moderate, medium, subangular blocky structure;

hard, friable; neutral; thin, nearly continuous films of clay on peds; clear, smooth boundary.

B22t—16 to 18 inches, reddish-brown (5YR 5/4) light clay loam, reddish brown (5YR 4/4) when moist; moderate, medium, subangular blocky parting to moderate, medium and fine, subangular blocky structure; hard, friable; calcareous; mildly alkaline; very thin patchy films of clay on faces of peds; clear, smooth boundary.

B3ca—18 to 24 inches, light reddish-brown (5YR 6/3) loam, reddish brown (5YR 5/4) when moist; weak or moderate, medium, subangular blocky parting to moderate, medium and fine, subangular blocky structure; hard, friable, moderately alkaline; visible lime in seams and fine concretions; gradual, smooth boundary.

C1ca—24 to 40 inches, light reddish-brown (5YR 6/3) loam, reddish brown (5YR 4.5/4) when moist; massive; very hard, friable; calcareous; moderately alkaline; visible lime in streaks and fine concretions; gradual, smooth boundary.

C2—40 to 60 inches, light reddish-brown (5YR 6/3) loam, reddish brown (5YR 4/4) when moist; massive; calcareous; moderately alkaline.

The A and B horizons have a hue of 7.5YR or 5YR. The A1 horizon is sandy loam or fine sandy loam. The B2t horizon is loam or clay loam. Depth to bedrock is typically more than 60 inches, but in small areas it is as shallow as 40 inches.

PoC—Potts sandy loam, 3 to 12 percent slopes. This soil is gently sloping to rolling and is on upland hills and ridges. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Palma and Batterson soils.

Runoff is moderate. The hazard of erosion is moderate.

This soil is used mainly for grazing and as wildlife habitat. Capability unit IVe–1 (irrigated), VIe–2 (nonirrigated); Loamy Foothills range site.

Rock Land

Ro—Rock land. This mapping unit consists of very shallow soil that is less than 2 inches deep over bedrock. It is strewn with stones and sandstone boulders. Stones, boulders, and outcrops of bedrock cover 50 to 70 percent of the surface.

Included in mapping are small areas of Batterson and Lazear soils.

The vegetation consists mainly of moderate to dense stands of pinyon and juniper trees. Some areas have a sparse understory of sagebrush and grass.

This mapping unit is used mainly as watershed and wildlife areas and for scenic and recreation uses. Capability unit VIIs–1; not placed in a range site.

Rock Outcrop

Rp—Rock outcrop. This mapping unit consists mainly of rock outcrop on very steep slopes, canyon slopes, cliffs, and steep mesa edges. The rock is mainly granite, sandstone, and shale.

Included in mapping are minor areas of stony and gravelly soils and small areas of shallow and very shallow soils. This mapping unit occurs throughout the survey area. The plant cover ranges from little or none to a few trees, shrubs, forbs, and grass.

Because of very steep slopes and poor accessibility, livestock grazing is impractical. The areas are used mainly as wildlife habitat. Because of the slopes, excessive runoff and erosion are major management concerns. Maximum protection of the existing plant cover helps to slow runoff and protect the areas from further erosion. Capability unit VIIIs–1; not placed in a range site.

Scholle Series

The Scholle series consists of deep, well-drained soils. These soils formed on stony alluvium fans and uplands. The slope is 3 to 12 percent, and elevation is 5,500 to 7,000 feet. The natural vegetation is mainly sagebrush, rabbitbrush, wheatgrass, and bluegrass. The average annual precipitation is 16 inches. The mean annual temperature is 50° F., and the frost-free season is 100 to 125 days.

In a representative profile the surface layer is brown stony loam about 5 inches thick. The subsoil is brown stony silty clay loam about 7 inches thick. The substratum is pinkish-white stony loam that extends to a depth of 40 inches or more.

Scholle soils have moderate permeability and a moderate available water capacity. They are neutral in the surface layer and moderately alkaline below that. Roots can penetrate to a depth of 40 inches or more.

These soils are used for grazing, as wildlife habitat, and for watershed areas.

Representative profile of Scholle stony loam, 3 to 12 percent slopes, NW¼ sec. 19, T. 12 S., R. 97 W., in an area of grass.

A1—0 to 5 inches, brown (10YR 5/3) stony loam, dark brown (10YR 3/3) when moist; moderate, medium, granular structure; slightly hard, friable; 30 percent basalt stones; noncalcareous; neutral; clear, smooth boundary.

B2t—5 to 12 inches, brown (7.5YR 5/4) stony silty clay loam, dark brown (7.5YR 3/4) when moist; moderate, medium, prismatic parting to moderate to strong, medium and fine, subangular blocky structure; very hard, friable; thin, nearly continuous films of clay; 30 percent basalt stones and gravel; calcareous in the lower 3 inches; mildly alkaline; gradual, smooth boundary.

C1ca—12 to 25 inches, pinkish-white (7.5YR 8/2) stony loam, light brown (7.5YR 5.5/4) when moist; moderate, fine, subangular blocky structure; hard, friable; 35 percent stones and cobbles; calcareous; moderately alkaline; gradual, wavy boundary.

C2ca—25 to 40 inches, pinkish-white (7.5YR 8/2) stony loam; massive; hard, friable; calcareous; moderately alkaline; about 30 percent stones and cobbles.

The A1 horizon is stony fine sandy loam or stony loam. The B horizon is stony silty clay loam or stony clay loam.

ScC—Scholle stony loam, 3 to 12 percent slopes. This soil is gently sloping to rolling and is on uplands and fans. It has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of soils that have a less stony surface layer and areas of Ildefonso soils.

Runoff is moderate. The hazard of water erosion is moderate.

The soil is used mainly for grazing and as wildlife habitat. The native vegetation (fig. 2) is mainly big sagebrush, rabbitbrush, western wheatgrass, bluebunch wheatgrass, bluegrass, and scattered pinyon

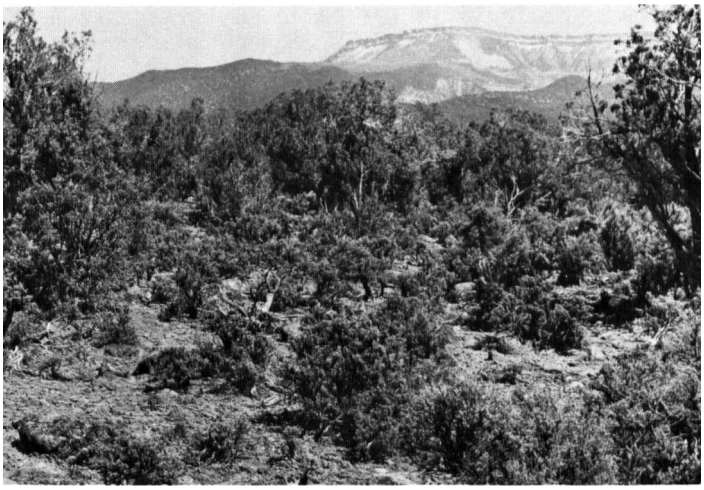

Figure 2.—Typical area of Scholle stony loam, 3 to 12 percent slopes.

and juniper trees. Capability unit VIe–2; Loamy Foothills range site.

Skyway Series

The Skyway series consists of moderately deep, well-drained soils. These soils formed in residuum from sandstone on mountain sides and mesas. The slope is 5 to 40 percent, and elevation is 8,000 to 9,500 feet. The natural vegetation is mainly sagebrush and grasses of the Subalpine zone. The average annual precipitation is 20 inches. The mean annual temperature is 38° F., and the frost-free season is 35 to 50 days.

In a representative profile the surface layer is very dark grayish-brown fine sandy loam about 23 inches thick. The underlying layer is light brownish-gray fine sandy loam over hard sandstone bedrock at a depth of about 32 inches.

Skyway soils have moderately rapid permeability and a moderate available water capacity. They are neutral throughout. Roots can penetrate to a depth of about 20 to 40 inches.

These soils are used for grazing, as wildlife habitat, and as watershed areas.

Representative profile of Skyway fine sandy loam, in an area of Mayflower-Skyway association, rolling, SE¼ sec. 25, T. 14 S., R. 102 W., in an area of grass.

A11—0 to 8 inches, very dark gray (10YR 3/1) fine sandy loam, black (10YR 2/1) when moist; weak, fine, granular structure; soft, very friable; neutral; gradual, smooth boundary.

A12—8 to 23 inches, very dark grayish-brown (10YR 3/2) fine sandy loam, very dark brown (10YR 2/2) when moist; weak, fine, subangular blocky parting to weak, fine, granular structure; slightly hard, very friable; neutral; clear, smooth boundary.

C—23 to 32 inches, light brownish-gray (10YR 6/2) fine sandy loam, brown (10YR 4/3) when moist; massive; hard, friable; 15 percent stones; neutral; abrupt, wavy boundary.

R—32 inches, sandstone.

Depth to bedrock ranges from 20 to 40 inches. Coarse fragments make up as much as 15 percent, by volume, of the soils. Skyway soils are mapped only in the Mayflower-Skyway association, rolling.

Splitro Series

The Splitro series consists of shallow, well-drained soils. These soils formed in residuum from sandstone on uplands, hills, and ridges. The slope is 6 to 12 percent, and elevation is 7,500 to 8,700 feet. The natural vegetation is mainly big sagebrush, rabbitbrush, wheatgrass, bluegrass, and needlegrass but includes sparse stands of oakbrush, ponderosa pine, aspen, pinyon, and juniper. The average annual precipitation is 20 inches. The mean annual temperature is 40° F., and the frost-free season is 35 to 60 days.

In a representative profile the surface layer is brown sandy loam about 7 inches thick. The underlying layer is brown stony sandy loam over hard reddish-brown sandstone, which is at a depth of about 15 inches.

Splitro soils have rapid permeability and a low available water capacity. They are neutral. Roots can penetrate to a depth of 12 to 17 inches.

These soils are used for grazing, as wildlife habitat, and for watershed.

Representative profile of Splitro sandy loam, in an area of Miracle-Splitro association, undulating, NW¼ sec. 27, T. 13 S., R. 102 W., in an area of grass.

A1—0 to 7 inches, brown (7.5YR 4/2) sandy loam, dark brown (7.5YR 3/2) when moist; weak, fine, crumb structure; slightly hard, very friable; neutral; clear, smooth boundary.

AC—7 to 15 inches, brown (7.5YR 5/2) stony sandy loam, dark brown (7.5YR 3/2) when moist; weak, medium, subangular blocky parting to weak, fine, granular structure; slightly hard, friable; about 30 percent fragments of sandstone; neutral; clear, wavy boundary.

R—15 inches, reddish-brown fractured sandstone.

The A1 horizon is sandy loam or stony sandy loam. Depth to bedrock ranges from 12 to 17 inches. Splitro soils are mapped only in the Miracle-Splitro association, undulating.

Stony Land

St—Stony land. This mapping unit is on moderately steep or steep colluvial or alluvial fans mainly in the Gateway part of the survey area. It consists of colluvial or alluvial materials derived from sandstone, granite, gneiss, and schist. The materials consist mainly of deposits of cobbles, boulders, and stones that are 10 to 200 feet thick or more.

Included in mapping are some areas of sandy loam or loamy sand 4 to 6 inches thick.

The water intake rate is very high, and the water holding capacity is low. The vegetation consists of scrubby pinyon and juniper, sparse grass, cottonthorn horsebrush, annual weeds, and cactus.

This mapping unit is used mainly as watershed and wildlife areas and for some scenic and recreation uses. Capability unit VIIs–1; not placed in a range site.

Uffens Series

The Uffens series consists of deep, well-drained soils that formed in sediment derived from mixed materials on mesas and terraces. The slope is 3 to 12 percent, and elevation is 4,800 to 5,100 feet. The natural vegetation is mainly saltbush, rabbitbrush, galleta, and Indian ricegrass. The average annual precipitation is 9 inches.

The mean annual temperature is 54° F., and the frost-free season is 160 to 175 days.

In a representative profile the surface layer is pink loam about 5 inches thick. The subsoil is brown clay loam and pink loam about 11 inches thick. It is underlain by pink fine sandy loam that extends to a depth of 50 inches or more.

Uffens soils have moderately slow permeability and a high available water capacity. They are strongly alkaline or very strongly alkaline. Roots can penetrate to a depth of more than 50 inches.

These soils are used for grazing, as wildlife habitat, and as watershed areas.

Representative profile of Uffens loam, 3 to 12 percent slopes, SW¼NE¼ sec. 7, T. 1 N., R. 1 E., in an area of grass.

A1—0 to 5 inches, pink (7.5YR 7/4) loam, brown (7.5YR 5/4) when moist; moderate, medium, platy parting to moderately fine, granular structure; soft, very friable; calcareous; strongly alkaline; abrupt boundary.

B21t—5 to 11 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) when moist; strong, medium, prismatic, parting to strong, medium, subangular blocky structure; very hard, firm; continuous films of clay on peds; calcareous; strongly alkaline; clear, smooth boundary.

B22t—11 to 16 inches, pink (7.5YR 7/4) loam, dark brown (7.5YR 4/4) when moist; moderate, medium, prismatic, parting to moderate, medium, subangular blocky structure; slightly hard, firm; thin patchy films of clay on peds; calcareous; very strongly alkaline; gradual, smooth, boundary.

C—16 to 50 inches, pink (7.5YR 7/4) fine sandy loam, brown (7.5YR 5/4) when moist; massive; slightly hard, friable; calcareous; very strongly alkaline; 25 percent sandstone, gravel, and cobbles.

The A1 horizon is very fine sandy loam, silt loam, or loam. Gravel and cobbles make up as much as 25 percent, by volume, of the C horizon.

UfC—Uffens loam, 3 to 12 percent slopes. This soil is gently sloping to rolling and is on terraces and mesas. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Avalon soils and soils that have a surface layer of stony loam.

Runoff is moderate. The hazard of erosion is moderate.

This soil is used for grazing and as wildlife habitat. Capability unit VIIe–1; Salt Flats range site.

Unaweep Series

The Unaweep series consists of deep, well-drained soils. These soils formed in sediment derived from sedimentary rock on alluvial fans and valley side slopes. The slope is 3 to 12 percent, and elevation is 6,700 to 7,300 feet. The natural vegetation is mainly sagebrush, rabbitbrush, wheatgrass, needlegrass, and native bluegrass and a sparse overstory of pinyon, juniper, and oakbrush. The average annual precipitation is 16 inches. The mean annual temperature is 50° F., and the frost-free season is 100 to 125 days.

In a representative profile the surface layer is grayish-brown sandy loam and brown fine sandy loam about 10 inches thick. The subsoil is reddish-brown fine sandy loam about 8 inches thick. The substratum is reddish-brown fine sandy loam that extends to a depth of 60 inches or more.

Unaweep soils have moderately rapid permeability and a moderate or high available water capacity. They are neutral or mildly alkaline in the upper 18 inches and moderately alkaline in the lowermost 42 inches. Roots can penetrate to a depth of more than 60 inches.

These soils are used for grazing, as wildlife habitat, and as watershed areas.

Representative profile of Unaweep sandy loam, 3 to 12 percent slopes, SE¼ sec. 26, T. 14 S., R. 101 W., in an area of grass.

A1—0 to 4 inches, grayish-brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; moderate, very fine, granular structure; soft, very friable; common flakes of mica; neutral; clear, wavy boundary.

A12—4 to 10 inches, brown (7.5YR 5/3) fine sandy loam, dark brown (7.5YR 3/3) when moist; weak, coarse, subangular blocky parting to weak, fine, granular structure; slightly hard, very friable; common flakes of mica; about 5 percent fragments of sandstone; mildly alkaline; clear, smooth boundary.

B2—10 to 18 inches, reddish-brown (5YR 5/3) fine sandy loam, reddish brown (5YR 4/3) when moist; moderate, medium, prismatic parting to moderate, medium, subangular blocky structure; slightly hard, very friable; common flakes of mica; few, thin, glossy surfaces on some peds; mildly alkaline; gradual, wavy boundary.

C—18 to 60 inches, reddish-brown (5YR 5/3) fine sandy loam, reddish brown (5YR 4/3) when moist; massive; slightly hard, very friable; common flakes of mica; 5 percent fragments of sandstone; calcareous; moderately alkaline.

The soil is sandy loam or fine sandy loam throughout. Depth to calcareous material is 15 to 30 inches.

UnC—Unaweep sandy loam, 3 to 12 percent slopes. This soil is gently sloping to rolling and is on fans and valley side slopes. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of a soil that has a stony or cobbly surface layer. Also included are small areas of Stony land.

Runoff is moderate. The hazard of erosion is moderate.

This soil is used mainly for grazing and as wildlife habitat. A few small areas are irrigated for alfalfa or pasture. Capability unit IVe–1 (irrigated), VIe–2 (nonirrigated); Loamy Foothills range site.

Utaline Series

The Utaline series consists of deep, well-drained soils. These soils formed in sediment that weathered from basalt on mesas and high terraces. The slope is 3 to 25 percent, and elevation is 4,800 to 5,700 feet. The natural vegetation is mainly saltbush, rabbitbrush, galleta, and Indian ricegrass. The average annual precipitation is 9 inches. The mean annual temperature is 52° F., and the frost-free season is 140 to 165 days.

In a representative profile the surface layer is pink stony loam about 4 inches thick. The underlying layer is pink, pinkish-white, and pinkish-gray very cobbly loam that extends to a depth of 60 inches or more.

Utaline soils have moderate permeability and a low available water capacity. They are moderately alka-

line. Roots can penetrate to a depth of more than 60 inches.

These soils are used for grazing, as wildlife habitat, and for watershed.

Representative profile of Utaline stony loam, 3 to 25 percent slopes, 500 feet south of the Delta-Mesa County line, SE¼NW¼ sec. 13, T. 4 S., R. 3 E., in an area of grass.

A1—0 to 4 inches, pink (7.5YR 7/4) stony loam, brown (7.5YR 5/4) when moist; moderate, medium, granular structure, but weak platy structure in upper 2 inches; 30 percent basalt stones and cobbles; slightly calcareous; moderately alkaline; clear, smooth boundary.

ACca—4 to 9 inches, pink (7.5YR 7/4) very cobbly loam, brown (7.5YR 5/4) when moist; weak, medium, subangular blocky structure; slightly hard, very friable; 50 percent basalt cobbles; some soft accumulation of calcium carbonate; moderately alkaline; gradual, wavy boundary.

C1ca—9 to 18 inches, pink (7.5YR 8/4) very cobbly loam, light brown (7.5YR 6/4) when moist; massive; slightly hard, friable; 50 percent basalt cobbles; calcareous; moderately alkaline; gradual, wavy boundary.

C2ca—18 to 40 inches, pinkish-white (7.5YR 8/2) very cobbly loam, pink (7.5YR 7/4) when moist; massive; slightly hard, friable; 75 percent basalt cobbles; much secondary calcium carbonate in finely divided form; moderately alkaline; diffuse, wavy boundary.

C3ca—40 to 60 inches, pinkish-gray (7.5YR 7/2) very cobbly loam, light brown (7.5YR 6/4) when moist; massive; slightly hard, friable; 80 percent basalt cobbles; much accumulated calcium carbonate but less than in C2ca horizon; moderately alkaline.

Fragments of basalt make up 35 to 85 percent, by volume, of the soil. The fine material is loam or clay loam.

UoD—Utaline stony loam, 3 to 25 percent slopes. This soil is gently sloping to steep and is on mesas and high terraces. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Ildefonso soils and of soils that are about 40 inches deep to shale.

Runoff is moderate to rapid. The hazard of water erosion is moderate or high.

This soil is used mainly for grazing and as wildlife habitat. Capability unit VIIe–1; Stony Salt Desert range site.

Us—Utaline-Shale outcrop complex. This complex is rolling to steep and is on mesa and terrace edges and breaks. It consists of about 65 percent Utaline stony loam and about 35 percent Shale outcrop. The Utaline soil has the profile described as representative of the series.

Included with this complex in mapping are a few small areas of Persayo soils.

Runoff is rapid. The hazard of water erosion is high.

This soil is used mainly for grazing and as wildlife habitat. Utaline soil is in capability unit VIIe–1 and in Stony Salt Desert range site; Shale outcrop was not placed in a capability group or in a range site.

Wet Alluvial Land

We—Wet alluvial land. This mapping unit consists of deep alluvium on stream bottoms, flood plains, and swales. This alluvium is highly stratified and is mainly sandy loam or fine sandy loam. The water table is high for at least part of the year. Vegetation is mostly rushes, sedges, and grasses. The growing season ranges from 50 to 75 days. Capability unit Vw–1; Mountain Meadow range site.

Witt Series

The Witt series consists of deep, well-drained soils. These soils formed in eolian deposits on upland hills and ridges. The slope is 3 to 12 percent, and elevation is 6,500 to 7,500 feet. The natural vegetation is mainly sagebrush, rabbitbrush, wheatgrass, and bluegrass. The average annual precipitation is 15 inches. The mean annual temperature is 50° F., and the frost-free season is 100 to 125 days.

In a representative profile the surface layer is reddish-brown fine sandy loam about 3 inches thick. The upper part of the subsoil is also reddish-brown fine sandy loam about 3 inches thick. The lower part of the subsoil is reddish-brown or reddish-yellow clay loam and pink silty clay loam about 41 inches thick. The substratum is pinkish-white loam that extends to bedrock, which is at a depth of about 58 inches.

Witt soils have moderate permeability and a high available water capacity. They are neutral to a depth of about 17 inches and moderately alkaline below that. Roots can penetrate to a depth of 50 to 60 inches. These soils are used for grazing, as wildlife habitat, and as watershed areas.

Representative profile of Witt fine sandy loam, in an area of Gibbler-Witt association, undulating, SW¼ sec. 7, T. 49 N., R. 17 W., in an area of grass.

A1—0 to 3 inches, reddish-brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) when moist; weak, medium, platy parting to weak, fine, granular structure; slightly hard, very friable; neutral; clear, smooth boundary.

B1—3 to 6 inches, reddish-brown (5YR 5/4) heavy fine sandy loam, reddish brown (5YR 4/4) when moist; weak, medium, subangular blocky structure; slightly hard, very friable; neutral; clear, smooth boundary.

B21t—6 to 17 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) when moist; moderate, medium, prismatic parting to moderate, medium, subangular blocky structure; hard, friable; moderate continuous films of clay on peds; neutral; clear, smooth boundary.

B22t—17 to 23 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) when moist; moderate, medium, prismatic parting to moderate, medium, subangular blocky structure; hard, firm; moderate, nearly continuous films of clay on peds; calcareous; moderately alkaline; clear, wavy boundary.

IIB2tca—23 to 47 inches, pink (5YR 8/3) silty clay loam, light reddish brown (5YR 6/4) when moist; moderate, medium, prismatic parting to moderate, medium, subangular blocky structure; hard, firm; moderate, nearly continuous films of clay on peds; calcareous; moderately alkaline; clear, smooth boundary.

IICca—47 to 58 inches, pinkish-white (5YR 8/2) loam, pink (5YR 7/3) when moist; massive; very hard, firm; calcareous; moderately alkaline; abrupt, clear boundary.

IIR—58 inches, sandstone and shale.

The A horizon is fine sandy loam or loam. The B2t horizon is clay loam or clay. Witt soils are mapped only in the Gibbler-Witt association, undulating.

Youngston Series

The Youngston series consists of deep, well-drained soils. These soils formed in alluvium on flood plains and alluvial fans. The slope is 0 to 3 percent, and elevation is 4,800 to 5,400 feet. The natural vegetation is mainly saltbush, rabbitbrush, galleta, and Indian ricegrass. The average annual precipitation is 9 inches. The mean annual temperature is 52° F., and the frost-free season is 160 to 175 days.

In a representative profile the surface layer is light-gray loam about 4 inches thick. The underlying layers are light brownish-gray sandy loam, very pale brown loam, and pale-brown very fine sandy loam and loam that extend to a depth of 60 inches or more.

Youngston soils have moderate permeability and a high available water capacity. They are moderately alkaline. Roots can penetrate to a depth of more than 60 inches.

These soils are used for grazing, as wildlife habitat, and as watershed areas.

Representative profile of Youngston loam, NW¼ sec. 9, T. 2 N., R. 2 W., in an area of grass.

A1—0 to 4 inches, light-gray (10YR 7/2) loam, dark grayish brown (10YR 4/2) moist; weak, thin, platy parting to weak, fine, granular structure; soft, very friable; calcareous; moderately alkaline; clear, smooth boundary.

AC—4 to 8 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) when moist; weak, thin, platy parting to weak, fine, granular structure; loose, very friable; calcareous; clear, smooth boundary.

C1—8 to 20 inches, very pale brown (10YR 7/3) loam, brown (10YR 5/3) when moist; weak, fine, subangular blocky parting to weak, fine, granular structure; slightly hard, friable; calcareous; moderately alkaline; clear, smooth boundary.

C2—20 to 38 inches, pale-brown (10YR 6/3) very fine sandy loam, dark brown (10YR 4/3) when moist; weak, fine, subangular blocky parting to weak, fine, granular structure; slightly hard, friable; calcareous; moderately alkaline; clear, smooth boundary.

C3—38 to 60 inches, pale-brown (10YR 6/3) loam, dark brown (10YR 4/3) when moist; massive; hard when dry, very friable when moist; calcareous; moderately alkaline.

The A1 is loam or very fine sandy loam. Coarse fragments make up as much as 15 percent, by volume, but commonly less than 5 percent of the soil.

Yo—Youngston loam. This soil is nearly level and is on flood plains and alluvial fans. It has the profile described as representative of the series.

Included with this soil in mapping are areas of Billings soils.

Runoff is slow to moderate. The hazard of erosion is moderate.

This soil is used mainly for grazing and as wildlife habitat. Capability unit VIe–1; Loamy Salt Desert range site.

Use and Management of the Soils

The soils in the Mesa County Area are used mainly for range. A small acreage is used for irrigated pasture, hay, and crops. This section discusses these uses and the suitability of the soils for roads, farm ponds, and other engineering structures. It also provides information on managing the soils for several land uses and for wildlife habitat.

Crops, Hay, and Pasture

The small acreage used for irrigated crops, hay, and pasture makes up less than 0.1 percent of the Mesa County Area. The main crops are barley, oats, and corn. Pasture and hay plantings are mainly alfalfa or a mixture of alfalfa or clover and brome or fescue grasses.

Estimated yields of crops are given in the discussion of individual capability units on the following pages. The range of yields given are those that can be expected from a reasonably high level of management which includes the following:

1. Using cropping systems that maintain good tilth and a high content of organic matter.
2. Controlling erosion to the maximum extent feasible, so that the quality of the soil is maintained or improved.
3. Maintaining a high level of fertility by using fertilizer in amounts recommended by the Colorado Agricultural Experiment Station.
4. Using crop residues to the fullest extent practicable to protect and improve the soil.
5. Following minimum tillage practices to reduce soil compaction and erosion.
6. Using adapted crop varieties.
7. Controlling weeds by tillage.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range or engineering.

In the capability system, the kinds of soil are grouped at three levels: the capability class, the subclass, and the unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce

the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife habitat.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, or water supply, or to esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife habitat, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–1 or VIe–3. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages the capability units in the Mesa County Area are described.

CAPABILITY UNIT IIe–1 (IRRIGATED)

Glenberg sandy loam, 0 to 3 percent slopes, is the only soil in this capability unit. It is deep, well-drained, and rapidly permeable. The available water capacity is low or moderate. The hazard of erosion is high. The average annual precipitation is about 16 inches, and the frost-free season is 100 to 125 days.

This soil is used for irrigated hayland and small grain. Under a high level of management the yield per acre of alfalfa hay is 3 to 5 tons; mixed clover and grass hay, 4 to 6 tons; and barley, 70 to 90 bushels.

The control of erosion and management of water are the major concerns in managing these soils. Improving irrigation methods, using crop residue, and other conservation practices help maintain a high rate of crop production and keep the soil in good condition.

CAPABILITY UNIT IIs–1 (IRRIGATED)

Billings silty clay loam is the only soil in this capability unit. It is deep, well-drained, and slowly permeable. The available water capacity is high. The hazard of erosion is moderate. The average annual precipitation is about 10 inches, and the frost-free season is 165 to 175 days.

This soil is suited to irrigated row crops, grain, pasture, and hay. Under a high level of management the yield per acre of alfalfa hay is 3 to 5 tons; corn, 125 bushels; barley, 90 bushels; and mixed clover and grass pasture yield 18 animal-unit-months of grazing.

The low intake rate and the slow percolation rate are the major concerns in managing these soils. Conservation practices, including managing irrigation water, using crop residue, and managing grazing, help maintain a high rate of crop production and good soil condition.

CAPABILITY UNIT IVe–1 (IRRIGATED)

This unit consists of deep, well-drained, moderately to rapidly permeable sandy loam soils. The slope is 3 to 12 percent. The available water capacity is moderate or high. The hazard of erosion is high or moderate. The average annual precipitation is about 16 inches, and the frost-free season is 100 to 125 days.

These soils are used for irrigated hay. Under a high level of management the yield per acre of alfalfa hay is 3 to 4 tons, and mixed clover and grass hay yield 4 to 6 tons.

Conservation practices such as contour irrigation and tillage practices that leave crop residue on the soil surface help control erosion and conserve moisture.

CAPABILITY UNIT Vw–1

This capability unit consists of Wet alluvial land, which is deep and poorly drained. The slope is 0 to 6 percent. The available water capacity is moderate. There is no hazard of erosion. The average annual precipitation is 16 to 20 inches, and the frost-free season is 50 to 75 days.

Wet alluvial land is used mainly for range and wildlife habitat.

CAPABILITY UNIT VIe–1

This unit consists of deep to shallow, well-drained, moderately to rapidly permeable sandy loam, loam, and gravelly loam soils. The slope is 0 to 25 percent. The available water capacity is low to high. The hazard of erosion is slight to high. The average annual precipitation is about 9 to 12 inches, and the frost-free season is 125 to 175 days.

These soils are used for range and wildlife habitat.

CAPABILITY UNIT VIe–2

This unit consists of shallow to deep, well-drained, slowly to very rapidly permeable stony loam, loam, fine sandy loam, silt loam, clay loam, sandy loam and loamy sand soils. The slope is 0 to 40 percent. The available water capacity is low to high. The hazard of

erosion is slight to high. The average annual precipitation is 15 to 20 inches, and the frost-free season is 35 to 125 days.

These soils are used for range and wildlife habitat.

CAPABILITY UNIT VIe–3

This unit consists of deep and moderately deep, well-drained, slowly to rapidly permeable loam and sandy loam soils. The slope is 0 to 40 percent. The available water capacity is moderate or low. The hazard of erosion is high. The average annual precipitation is about 20 inches, and the frost-free season is 35 to 50 days.

These soils are used mainly for wood production and wildlife habitat. Some areas are used for grazing cattle and sheep.

Conservation practices such as controlling fire, selective cutting of trees, and forest reseeding help maintain production and control erosion.

CAPABILITY UNIT VIIe–1

This unit consists of shallow to deep, slowly permeable to rapidly permeable loamy sand, cobbly sandy loam, loam, silt loam, silty clay, and stony loam soils. The slope is 3 to 30 percent. The available water capacity is low to high. The hazard of erosion is high or moderate. The average annual precipitation is 9 to 14 inches, and the frost-free season is 110 to 175 days.

These soils are used for range and wildlife.

CAPABILITY UNIT VIIe–2

This unit consists of deep and moderately deep, well-drained, slowly to rapidly permeable loam and sandy loam soils. The slope is 40 to 60 percent. The available water capacity is low or moderate. The hazard of erosion is very high. The average annual precipitation is about 20 inches, and the frost-free season is 35 to 50 days.

These soils are used for woodland, wildlife habitat, and as watershed areas.

Conservation practices such as limited selective cutting and reforestation help maintain forest production and wildlife cover and control erosion.

CAPABILITY UNIT VIIw–1

Bankard loamy sand is the only soil in this capability unit. It is deep, well-drained, and rapidly permeable. The slope is 1 to 5 percent. The available water capacity is low. The hazard of erosion is high or moderate. The average annual precipitation is about 10 inches, and the frost-free season is 165 to 175 days.

These soils are used for range and wildlife habitat. They are subject to flooding.

CAPABILITY UNIT VIIs–1

This unit consists of Rock land and Stony land. These areas are mostly deposits of cobbles, boulders, and stones. Outcrops of bedrock and small areas of very shallow soils are included. The slope is 3 to 60 percent. The available water capacity is low. The average annual precipitation is about 16 inches, and the frost-free season is 100 to 125 days.

Rock land and Stony land are poorly suited to grass. They are used mostly as wildlife habitat. Pinyon, juniper, sagebrush, and forbs are the major plants.

Controlling erosion is the major management concern. Conservation practices such as managing wildlife and controlling grazing help maintain or improve the present cover and control erosion.

CAPABILITY UNIT VIIs–2

Billings silty clay loam is the only soil in this capability unit. It is deep, well drained, and slowly permeable. The slope is 0 to 3 percent. The available water capacity is high. The average annual precipitation is about 10 inches, and the frost-free season is 165 to 175 days.

The soil is used for range and as wildlife habitat.

CAPABILITY UNIT VIIIe–1

This unit consists of Badland and Gullied land. The areas are severely eroded, are mostly barren, and have a very high hazard of erosion. Nearly all of the precipitation in these areas carries much sediment as it runs off.

This area is scenic. It is used as a place of refuge by many kinds of wildlife.

CAPABILITY UNIT VIIIw–1

This capability unit consists of Alluvial land. This land is gravelly and cobbly alluvium. The slope is 0 to 5 percent. The available water capacity is low. The average annual precipitation is 13 inches, and the frost-free season is 140 to 160 days. Flooding is common.

Alluvial land is suited mainly to wildlife habitat and limited grazing. It has value as a source of sand and gravel.

CAPABILITY UNIT VIIIs–1

This capability unit consists of Rock outcrop, which occurs on very steep slopes, canyon slopes, cliffs, and steep edges of mesas.

The areas provide some food and protection for many kinds of wildlife. Because the slope is very steep, excessive runoff and erosion are major concerns of management. Protecting the existing plant cover helps to slow runoff and protect the areas from erosion.

Range [2]

Soils that produce the same kinds, amounts and proportions of range plants are grouped into range sites. The potential, or climax, plant community consists of plants growing in a range site that has not undergone a drastic disturbance. Climax plant communities have no given composition and the kinds and amounts of plants can vary, within reasonable limits, from year to year and from place to place.

Any disturbance such as overuse by livestock, excessive burning, erosion, or plowing can change the climax plant community or completely destroy it if the disturbance is drastic. If a range site has not deteriorated significantly, secondary plants can reestablish the natural climax plant community.

When changes occur in the climax plant community because of use by livestock or other disturbances, some plants increase and others decrease. *Decreasers* are plants in the original community that tend to die out if heavily grazed. They are generally the tallest, most productive, and most palatable perennials. *Increasers*

[2] THOMAS K. EAMAN and FORREST C. MAHAFFEY, range conservationists, Soil Conservation Service, helped prepare this section.

are those plants that normally become more abundant as the decreasers decline. Generally they are shorter, and some are less palatable than decreasers. Plants that become established when more desirable ones decline are *invaders*.

Management programs for range generally try to increase desirable plants and restore rangeland to climax condition. Some programs are designed to create or maintain plant communities that fit specific needs in the grazing program, to provide for wildlife habitat or for other benefits.

In the following pages, the range sites of Mesa County Area are described and the climax plants and principal invaders on the sites are named. An estimate of the potential annual yield of air-dry herbage for each site if it is in excellent condition is also given. The soils in each site can be determined by referring to the "Guide to Mapping Units" at the back of this soil survey.

SALT FLATS RANGE SITE

The soils in this range site have a surface layer of fine sand, loamy sand, loam, and silty clay loam. They have slow to rapid permeability and a low to high available water capacity. The slope is 0 to 12 percent. Annual precipitation is about 10 inches, and most of it occurs as snow during October through April.

Some of the grasses, forbs, and shrubs in the potential plant community that tolerate highly saline soil are alkali sacaton, saltgrass, western wheatgrass, green molly, fourwing saltbush, and greasewood. The availability of moisture greatly affects the growth of these and other plants. The site receives water mainly from runoff from adjoining uplands or occasionally from overflowing streams.

Alkali sacaton makes up about 25 percent, by air-dry weight, of the plant community. Western wheatgrass makes up 10 percent; saltgrass, 7 percent; galleta, 5 percent; and other grasses, 8 percent. The forbs include green molly, which makes up 4 percent; globe mallow, 3 percent; and other forbs, 3 percent. The shrubs include four-wing saltbush, which makes up 10 percent; shadscale, 5 percent; greasewood, 4 percent; and other shrubs, 16 percent.

The total annual yield of the plant community, by air-dry weight, ranges from 600 pounds per acre in years of favorable moisture to 400 pounds in other years. About 75 percent of the yield is used as forage and browse for sheep and cattle.

Continued heavy grazing by livestock or other disturbance changes the kind and amount of plants in this range site. Alkali sacaton, four-wing saltbush, and western wheatgrass become less abundant, and they are replaced by greasewood and annual weeds such as kochia and Russian-thistle.

Conservation practices such as controlled grazing and deferred grazing help to maintain or improve the range condition and to control erosion. A good distribution of livestock grazing can be encouraged by selective placement of livestock watering facilities.

SILTY SALT DESERT RANGE SITE

The soils in this range site have a surface layer of silt loam. They have moderately slow or slow permeability and a low available water capacity. They range from nonsaline to moderately saline. The slope is 3 to 25 percent. Annual precipitation is about 9 inches, and most of it occurs as snow during October through April.

Some of the grasses, forbs, and shrubs in the potential plant community of this site need an arid environment and moderately saline soil. These plants are galleta, Indian ricegrass, Salina wildrye, rabbitbrush, and saltbush (fig. 3).

Galleta makes up about 35 percent, by air-dry weight, of the plant community. Indian ricegrass makes up 6 percent; Salina wildrye, 6 percent; squirreltail, 4 percent; and other grasses, 4 percent. The forbs include globe mallow, which makes up 3 percent; Hood's phlox, 2 percent; Indian paintbrush, 2 percent; and other forbs, 3 percent. The shrubs include shadscale, which makes up 15 percent; Douglas rabbitbrush, 5 percent; Gardner saltbush, 3 percent; big sagebrush, 2 percent; and other shrubs, 10 percent.

The total annual yield of the plant community, by air-dry weight, ranges from 650 pounds per acre in years of favorable moisture to 400 pounds in other years. About 60 percent of the yield is used as forage and browse for sheep and cattle.

Continued heavy grazing by livestock or other disturbance changes the kind and amount of plants in this range site. Galleta and Indian ricegrass become less abundant, and they are replaced by shadscale, pricklypear, and other less palatable plants.

Conservation practices such as controlling grazing and deferred grazing help maintain or improve the range condition and control erosion. A good distribution of livestock grazing can be encouraged by selective placement of livestock watering facilities.

CLAYEY SALT DESERT RANGE SITE

The soils in this range site have a surface layer of silty clay. They have slow permeability and a low available water capacity. The slope is 3 to 25 percent.

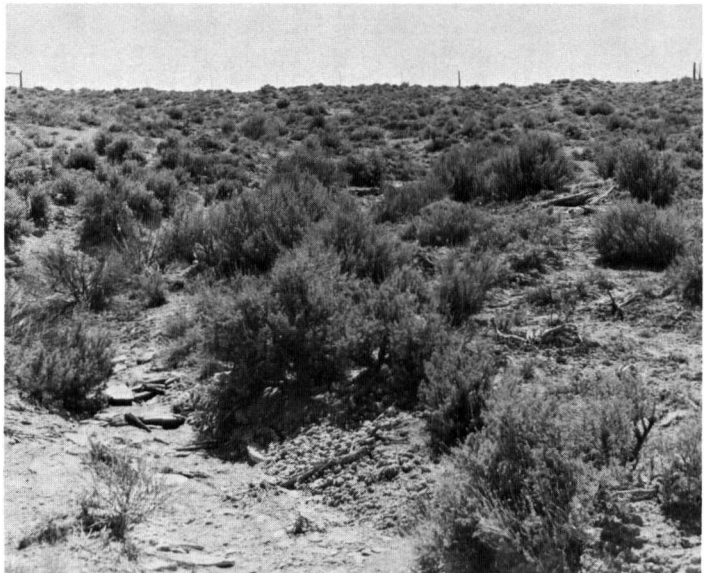

Figure 3.—**Silty Salt Desert range site in an area of Persayo silt loam, 3 to 25 percent slopes.**

Annual precipitation is about 9 inches, and most of it occurs as snow during October through April.

Shallow depth, high salinity, and slow permeability are the main influences on the kind and amount of plants. Only those plants that can adapt to and tolerate clayey and saline soils in an arid climate grow on this site. Saltbush is the main plant. A few grasses, forbs, and shrubs form a sparse ground cover.

Galleta makes up about 20 percent, by air-dry weight, of the plant community. Indian ricegrass makes up 5 percent; squirreltail, 3 percent; and other grasses, 7 percent. Forbs include globe mallow, which makes up 2 percent; sego lily, 1 percent; asters and fleabanes, 1 percent; and other forbs, 1 percent. The shrubs include shadscale, which makes up 30 percent; mat saltbush, 10 percent; Gardner saltbush, 5 percent; Douglas rabbitbrush, 3 percent; bud sagebrush, 2 percent; and other shrubs, 10 percent.

The total annual yield of the plant community, by air-dry weight, ranges from 500 pounds per acre in years of favorable moisture to 300 pounds in other years. About 50 to 60 percent of the yield is used as forage and browse for sheep and cattle.

Continued heavy grazing by livestock and other drastic disturbance can reduce this range site to a very sparse cover of prostrate saltbushes. Only a few grasses remain in the advanced stages of range deterioration.

Conservation practices such as controlled grazing and deferred grazing help maintain or improve the condition and control erosion. A good distribution of livestock grazing can be encouraged by selective placement of livestock watering facilities.

LOAMY SALT DESERT RANGE SITE

The soils in this range site have a surface layer of loam, stony loam, gravelly loam, and sandy loam. They have moderate to rapid permeability and a high to low available water capacity. The slope is 0 to 25 percent. Annual precipitation is about 9 to 12 inches, and most of it occurs as snow during October through April.

Grasses and shrubs are generally abundant in the potential plant community of this site. Galleta, Indian ricegrass, needleandthread, and squirreltail are the most common grasses, and shadscale and Gardner saltbush are common shrubs. The main forbs are biscuit root, globe mallow, Indian paintbrush, sego lily, and Hood's phlox.

Galleta makes up about 35 percent, by air-dry weight, of the plant community. Indian ricegrass makes up 5 percent; needleandthread, 5 percent; squirreltail, 3 percent; and other grasses, 2 percent. The forbs include Hood's phlox, which makes up 2 percent; globe mallow, 2 percent; buckwheat, 2 percent; loco, 1 percent; and other forbs, 3 percent. The shrubs include shadscale, which makes up 10 percent; Gardner saltbush, 8 percent; winterfat, 5 percent; Douglas rabbitbrush, 5 percent; snakeweed, 2 percent; and other shrubs, 10 percent.

The total annual yield of the plant community, by air-dry weight, ranges from 800 pounds per acre in years of favorable moisture to 500 pounds in other years. About 65 percent of the yield is used as forage for cattle.

Repeated overgrazing or other damaging disturbances change the kind and amount of plants on this range site. Galleta, Indian ricegrass, and most of the other grasses thin out and are partly replaced by cheatgrass, shadscale, pricklypear, and other less palatable plants.

Conservation practices such as controlled grazing use and deferred grazing help maintain or improve the range condition and control erosion. A good distribution of livestock grazing can be encouraged by fencing and by selective placement of livestock watering facilities.

STONY SALT DESERT RANGE SITE

The soils in this range site have a surface layer of stony loam or cobbly sandy loam. They have moderate permeability and low available water capacity. The slope is 3 to 25 percent. Annual precipitation is about 9 to 11 inches, and most of it occurs as snow during October through April.

Galleta and shadscale make up most of the plant community. Growing with these are Indian ricegrass, needleandthread, globe mallow, bud sagebrush, and pricklypear (fig. 4).

Galleta makes up about 30 percent, by air-dry weight, of the plant community. Indian ricegrass makes up 15 percent; needleandthread, 3 percent; squirreltail, 2 percent; and other grasses, 5 percent. The forbs include globe mallow, which makes up 3 percent; Indian paintbrush, 2 percent; Hood's phlox, 2 percent; and other forbs, 3 percent. The shrubs include shadscale, which makes up 20 percent; bud sagebrush, 5 percent; winterfat, 5 percent; Douglas rabbitbrush, 5 percent; and other shrubs, less than 1 percent.

The total annual yield of the plant community, by air-dry weight, ranges from 800 pounds per acre in years of favorable moisture to 500 pounds in other years. About 75 percent of the yield is used as forage for cattle.

Continued heavy grazing by livestock or other disturbance changes the kind and amount of plants in the range site. Snakeweed, pricklypear, and shadscale in-

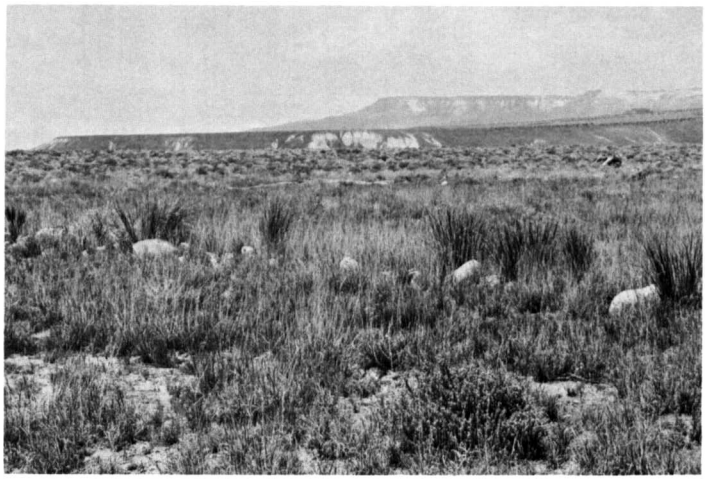

Figure 4.—**Stony Salt Desert range site in an area of Utaline stony loam, 3 to 25 percent slopes.**

crease sharply as galleta, Indian ricegrass, and other more palatable plants decline. Further deterioration of this site leaves much bare ground and only a few of the former perennial plants.

Conservation practices such as controlled grazing use and deferred grazing help maintain and improve the range condition and control erosion. A good distribution of livestock grazing can be encouraged by selective placement of livestock watering facilities.

LOAMY FOOTHILLS RANGE SITE

The soils in this range site have a surface layer of loam, fine sandy loam, stony loam, and sandy loam. They have slow to rapid permeability and a moderate or high available water capacity. The slope is 0 to 12 percent. Annual precipitation is about 16 inches, and most of it occurs as snow during October through April.

The potential plant community of this site is a nearly unbroken cover of grasses and an overstory of scattered big sagebrush. Western wheatgrass, Indian ricegrass, and muttongrass are the main plants in the cover. Lupine, penstemon, and Indian paintbrush are the main forbs. In addition to big sagebrush, there is a scattering of rabbitbrush, winterfat, four-wing saltbush, and other shrubs.

Western wheatgrass makes up about 30 percent, by air-dry weight, of the plant community. Indian ricegrass makes up 10 percent; muttongrass, 10 percent; bluebunch wheatgrass, 5 percent; needleandthread, 5 percent; squirreltail, 3 percent; and other grasses, 2 percent. The forbs include lupine, which makes up 3 percent; penstemon, 2 percent; Indian paintbrush, 2 percent; and other forbs, 3 percent. The shrubs include big sagebrush, which makes up 10 percent; Douglas rabbitbrush, 3 percent; four-wing saltbush, 3 percent; winterfat, 2 percent; bitterbrush, 2 percent; and other shrubs, 5 percent.

The total annual yield of the plant community, by air-dry weight, ranges from 1,500 pounds per acre in years of favorable moisture to 1,000 pounds in other years. About 67 percent of the total yield is used as forage and browse for cattle.

Continued overgrazing or other disturbance reduces the percentage of perennial grasses, especially bunch grasses, and increases big sagebrush, rabbitbrush, snakeweed, and other shrubs. Cheatgrass is one of the plants invading the site.

Conservation practices such as controlled grazing, deferred grazing, and brush management help maintain or improve the range condition and control erosion. Fencing and selective placement of livestock watering facilities help distribute livestock grazing. Areas that have deteriorated can be seeded to adapted plants.

SANDY FOOTHILLS RANGE SITE

The soils in this range site have a surface layer of loamy sand or sandy loam. They have very rapid or rapid permeability and a low or moderate available water capacity. The slope is 9 to 12 percent. Annual precipitation is about 16 inches, and most of it occurs as snow during October through April.

Indian ricegrass, needleandthread, and bluebunch wheatgrass make up the bulk of the cover in the potential plant community of this site. Other grasses are basin wildrye, blue grama, sand dropseed, and muttongrass. The major forbs are balsamroot, lupine, buckwheat, loco, penstemon, and globemallow. Big sagebrush, four-wing saltbush, Douglas rabbitbrush, and bitterbrush are the main shrubs (fig. 5).

Indian ricegrass makes up about 35 percent, by air-dry weight, of the plant community. Needleandthread makes up 10 percent; bluebunch wheatgrass, 10 percent; sand dropseed, 5 percent; and other grasses, 5 percent. The forbs include arrowleaf balsamroot, which makes up 5 percent; lupine, 2 percent; buckwheat, 2 percent; and other forbs, 1 percent. The shrubs include big sagebrush, which makes up 10 percent; four-wing saltbush, 5 percent; Douglas rabbitbrush, 3 percent; bitterbrush, 3 percent; and other shrubs, 4 percent.

The total annual yield of the plant community, by air-dry weight, ranges from 700 pounds per acre in years of favorable moisture to 600 pounds in other years. About 75 percent of the yield is used as forage and browse for cattle.

Continued overgrazing or other disturbance reduces the perennial bunchgrasses and increases shrubs, especially rabbitbrush. In large bare areas, cheatgrass and other annuals are invading. Wind erosion can be severe if an adequate plant cover is not maintained.

Conservation practices such as controlled grazing, deferred grazing, and brush management help maintain or improve the range condition and control erosion. Fencing and selective placement of livestock watering facilities help distribute livestock grazing. Areas that have deteriorated can be seeded to adapted plants.

CLAYEY FOOTHILLS RANGE SITE

The soils in this range site have a surface layer of clay loam. They have slow permeability and a high available water capacity. The slope is 3 to 12 percent. Annual precipitation is about 15 inches, and most of it occurs as snow during October through April.

Western wheatgrass is the major plant in the plant community of this site. This grass, muttongrass, beardless wheatgrass, Indian ricegrass, and other grasses make up more than half of the total plant cover. Buckwheat, globe mallow, yarrow, penstemon, and other forbs and such shrubs as big sagebrush, winterfat, pricklypear, and Douglas rabbitbrush are in the plant community.

Western wheatgrass makes up about 40 percent, by air-dry weight, of the plant community. Beardless wheatgrass makes up 5 percent; Indian ricegrass, 5 percent; muttongrass, 5 percent; squirreltail, 2 percent; and other grasses, 8 percent. The forbs include buckwheat, which makes up 2 percent; globemallow, 2 percent; yarrow, 2 percent; and other forbs, 4 percent. The shrubs include big sagebrush, which makes up 15 percent; winterfat, 4 percent; Douglas rabbitbrush, 3 percent; pricklypear, 1 percent; and other shrubs, 2 percent.

The total annual yield of the plant community, by air-dry weight, ranges from 1,200 pounds per acre in years of favorable moisture to 700 pounds in other years. About 75 percent of the yield is used as forage and browse for cattle.

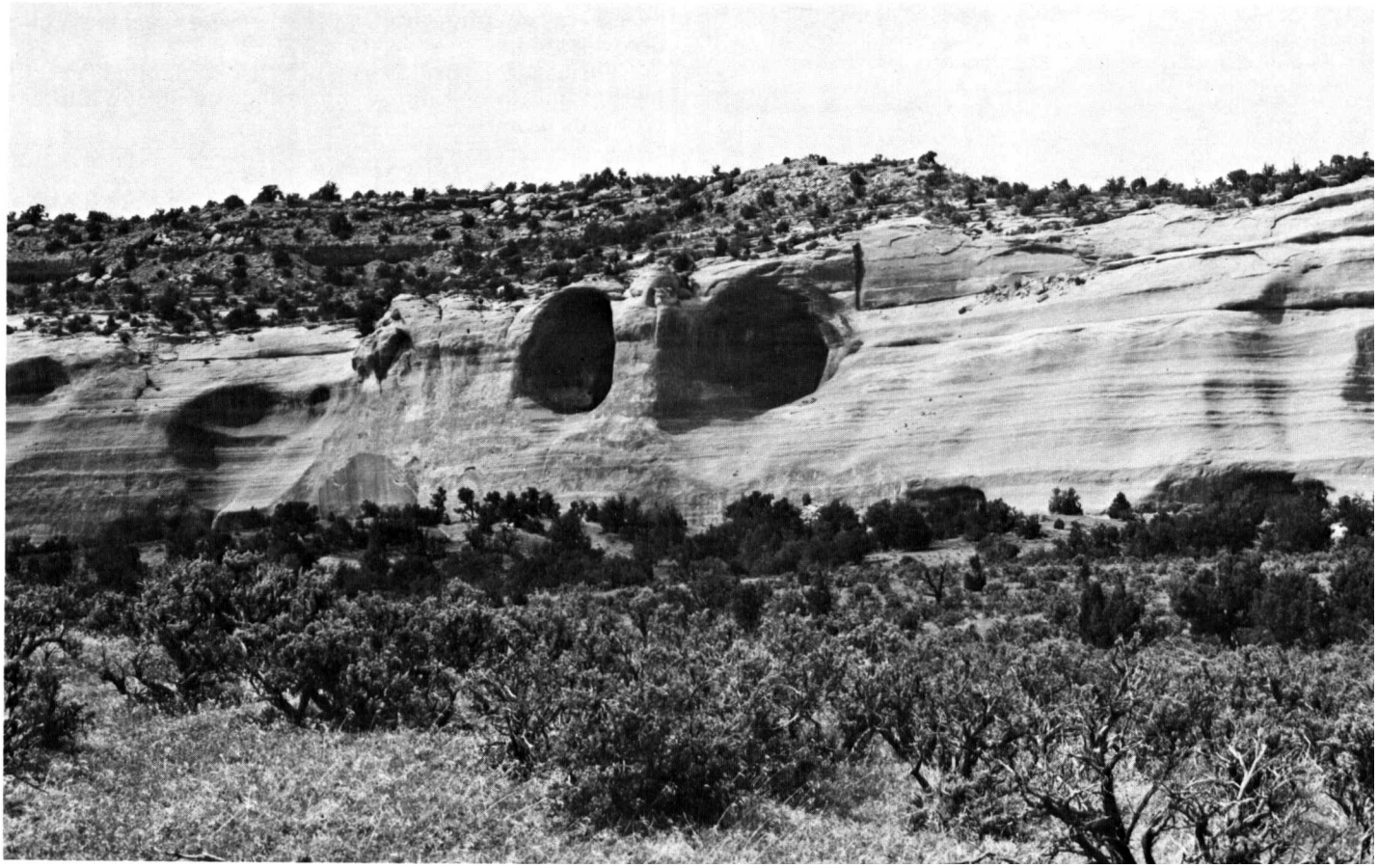

Figure 5.—**Sandy Foothills range site in an area of Dwyer loamy sand, 3 to 12 percent slopes. Rock outcrop is in the background.**

Continued heavy grazing and other major disturbances reduce the perennial grasses and increase big sagebrush, pricklypear, and rabbitbrush. Cheatgrass is a common invader if this site is allowed to deteriorate.

Conservation practices such as controlled grazing, deferred grazing, and brush management help maintain or improve the range condition and control erosion. Fencing and selective placement of livestock watering facilities help distribute grazing. Areas that have deteriorated can be seeded to adapted plants.

MOUNTAIN LOAM RANGE SITE

The soils in this range site have a surface layer of fine sandy loam, sand, and loam. They have slow to rapid permeability and a low or moderate available water capacity. The slope is 3 to 30 percent. Annual precipitation is about 20 inches, and most of it occurs as snow during September through May.

A mixture of grasses, forbs, and shrubs of the Intermediate Mountain zone makes up the potential plant community of this site. The main grasses are Arizona fescue, western wheatgrass, and muttongrass. Common forbs are geranium, lupine, larkspur, paintbrush, buckwheat, and herbaceous sage. Shrubs include big sagebrush, bitterbrush, serviceberry, and snowberry (fig. 6).

Arizona fescue makes up about 20 percent, by air-dry weight, of the plant community. Western wheatgrass makes up 15 percent; muttongrass, 15 percent; letterman's needlegrass, 5 percent; Sandberg bluegrass, 5 percent; nodding bromegrass, 5 percent; and other grasses, 7 percent. The forbs include American vetch, which makes up 2 percent; Indian paintbrush, 2 percent; silvery lupine, 1 percent; sulfur buckwheat, 1 percent; and other forbs, 5 percent. The shrubs include big sagebrush, which makes up 12 percent; snowberry, 2 percent; Douglas rabbitbrush, 1 percent; and other shrubs, 2 percent.

The total annual yield of the plant community, by air-dry weight, ranges from 1,800 pounds per acre in years of favorable moisture to 1,200 pounds in other years. About 75 percent of the yield is used as forage for cattle and sheep.

Continued heavy grazing or other disturbance greatly decreases the kinds and amounts of forage plants, and sagebrush, oakbrush, and annual weeds invade the site.

Conservation practices such as controlled grazing, deferred grazing, and brush management help maintain or improve the range condition and control erosion. Fencing and selective placement of livestock watering facilities can help distribute grazing. Areas that have deteriorated can be seeded to adapted plants.

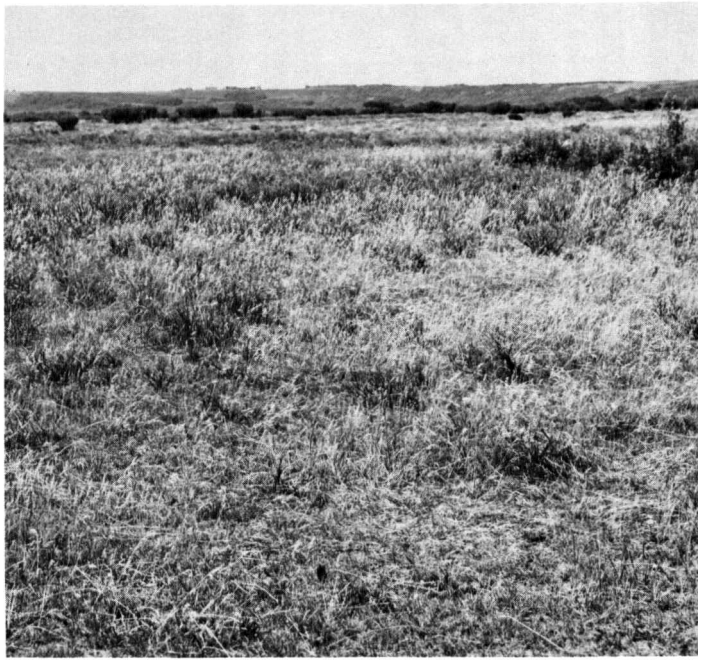

Figure 6.—**An area of Owen Creek-Miracle complex, 3 to 12 percent slopes, in the Mountain Loam range site.**

MOUNTAIN MEADOW RANGE SITE

This range site consists of Wet alluvial land. It mostly has a surface layer of fine sandy loam or sandy loam. The alluvium is highly stratified and has a high water table during part of the year. The slope is 0 to 6 percent. Annual precipitation is about 18 inches, and most of it occurs as snow during October through April. Poor drainage and a high water table are the main influences on the kind and amount of vegetation.

Grasses, sedges, rushes mixed with forbs, and some willows are the potential plant community of this site. The site is bounded in many places by streambank plants or forests. Plant growth is not controlled by seasonal precipitation because subsurface water is present (fig. 7).

Tufted hairgrass makes up about 40 percent of the plant community. Slender wheatgrass makes up 10 percent; Nebraska sedge, 5 percent; baltic rush, 5 percent; foxtail barley, 2 percent; and other grasses and grasslike plants, 16 percent. The forbs include cow parsnip, which makes up 5 percent; wild celery, 4 percent; Rocky Mountain iris, 2 percent; snowy cinquefoil, 2 percent; and other forbs, 5 percent. The shrubs include willow, which makes up 2 percent; and shrubby cinquefoil, 2 percent.

The total annual yield of the plant community fluctuates less on this site than on others. Moisture is available from the water table. The yield ranges from 4,000 pounds per acre, by air-dry weight, in years of favorable moisture to 3,000 pounds in other years. About 85 percent of the yield is used as forage for sheep and cattle.

Large numbers of livestock and overgrazing cause many of the most palatable forage plants to give way to less desirable plants. Broken sod, many weeds, and excessive gullying occurs if the site becomes more deteriorated.

Conservation practices such as controlled grazing help maintain or improve the range condition and control erosion.

SUBALPINE LOAM RANGE SITE

The soils in this range site have a surface layer of silt loam or fine loam. They have slow to moderately rapid permeability and a moderate available water capacity. The slope is 5 to 40 percent. Annual precipitation is about 20 inches, and most of it occurs as snow during September through May.

The potential plant community of this site is mainly tall bunchgrasses.

Thurbers fescue makes up about 40 percent, by air-dry weight, of the plant community. Bearded wheatgrass makes up 5 percent; Columbia needlegrass, 5 percent; needleandthread, 5 percent; mountain brome and nodding brome, 6 percent; and other grasses, 5 percent. The forbs include blue lupine, which makes up 5 percent; aspen peavine, 6 percent; and other forbs, 5 percent. The shrubs include silver sagebrush, which makes up 10 percent; snowberry, 3 percent; and other shrubs, 5 percent.

The total annual yield of the plant community, by air-dry weight, ranges from 4,000 pounds per acre in years of favorable moisture to 2,000 pounds in other years. About 85 to 90 percent of the yield is used as forage for sheep and cattle.

Severe disturbance of this site reduces the principal forage plants and increases the plants that are less palatable. Continued heavy grazing, repeated burning, or plowing are destructive disturbances that significantly change the plant community.

Conservation practices, such as controlled grazing, deferred grazing, selective placement of livestock watering facilities, and brush management, help maintain or improve the range condition and control erosion. Areas that have deteriorated can be seeded to adapted plants.

Wildlife

The Mesa County Area provides habitat for a variety of wildlife, including migratory animals and birds. The northern bald eagle spends winter along the major streams, and the rough-winged swallow stays in this area during summer and in Central America during winter. The major animals in the survey area include mule deer, elk, black bear, mountain lion, turkey, desert cottontail, blue grouse, chukar, ducks, and Canada geese.

Each kind of wildlife needs certain elements of habitat to survive and thrive. The major elements of habitat are food, cover, and water. Others include climate, weather, light, nutrients, atmospheric gases, temperature, and certain organisms. These factors generally are not controlled by man.

Soils differ in their ability to produce certain elements of habitat. A system was developed to indicate the degree to which various soils can provide these elements for different kinds of wildlife.

Most wildlife habitats are managed by planting

Figure 7.—**Mountain Meadow range site in an area of Wet alluvial land.**

suitable plants, manipulating existing plants to create a more natural plant community, or increasing or improving desired plants. Water areas also can be created or natural ones improved as wildlife habitats.

Soil interpretations for wildlife habitat help in selecting suitable sites for various kinds of management. They indicate the intensity of management needed to achieve satisfactory results. They also serve as a means of showing why it may not be feasible to manage a particular area for a given kind of wildlife. These interpretations also can help in broad-scale planning of wildlife management areas, parks, and nature areas, or in acquiring land for wildlife.

Each soil is rated according to its suitability for producing various kinds of plants and other elements that make up wildlife habitat. The ratings take into account mainly those characteristics of soils that are closely related to natural factors in the environment. They do not take into account climate, current use of soils, or distribution of wildlife and people. For this reason, a site should be inspected before development.

In table 2 the soils of this survey area are rated according to their suitability for producing seven elements of wildlife habitat and for four kinds of wildlife. The ratings that indicate relative suitability are explained in the following paragraphs.

Good means that the habitats are easily improved, maintained, or created. There are few or no soil limitations in habitat management, and satisfactory results can be expected.

Fair means that the habitats can be improved, maintained, or created on these soils, but moderate soil limitations affect habitat management or development. A moderate intensity of management and fairly frequent attention may be needed for satisfactory results.

Poor means that the habitats can be improved, maintained, or created on these soils but the soil limitations are severe. Habitat management may be difficult and expensive and may require intensive effort, and the results are generally marginal.

Very poor means that under the prevailing soil conditions, it is impractical to attempt to improve, maintain, or create habitats. Unsatisfactory results are probable.

Grain and seed include wheat, barley, oats, and other annual grain-producing plants.

Grass and legumes are established by planting. They provide food and cover for wildlife. The grasses include wheatgrasses, needlegrasses, and the legumes include alfalfa, yellow sweetclover, and other clovers.

Wild herbaceous plants consist of native or introduced perennial grasses, forbs, and weeds that provide food and cover for upland wildlife. Typical plants are

TABLE 2.

Soil series	Suitability for elements of wildlife habitat			
	Grain and seed	Grass and legumes	Wild herbaceous plants	Coniferous plants
Alluvial land: Ad	Very poor	Very poor	Fair	
Avalon: AvA, AvC	Poor	Poor	Poor	
Badland: Ba	Very poor	Very poor	Poor	
Bangston	Very poor	Very poor	Good	Good
Bankard: Bd	Poor	Fair	Fair	
Batterson: BrC For Rock outcrop part, see Rock outcrop.	Very poor	Very poor	Poor	Very poor
Billings: Bs.				
Irrigated	Fair	Fair	Good	Good
Nonirrigated	Very poor	Very poor	Very poor	Very poor
Blackston: BtD	Very poor	Very poor	Poor	
Cebone.				
2 to 25 percent slope	Poor	Poor	Good	Good
More than 25 percent slope	Very poor	Very poor	Good	Good
Chipeta: ChD	Very poor	Very poor	Very poor	Very poor
Dominguez: DoC	Poor	Poor	Fair	
Dwyer: DwC	Poor	Poor	Fair	Poor
Fruita: FaC For Avalon part, see that series.	Very poor	Very poor	Poor	
Gateway: GcE, GcF.				
2 to 25 percent slope	Poor	Poor	Good	Good
More than 25 percent slope For Bangston and Cebone parts, see those series.	Very poor	Very poor	Good	Good
Gibbler: GeC For Witt part, see that series.	Poor	Poor	Fair	Poor
Glenberg: GlA, GlB.				
Irrigated	Good	Good		
Nonirrigated	Fair	Fair	Fair	
Gullied land: Gu	Very poor	Very poor	Poor	
Ildefonso: IdC	Poor	Poor	Fair	
Lazear: LkE For Rock outcrop part, see Rock outcrop.	Very poor	Very poor	Fair	
Loma: Lo	Poor	Poor	Fair	
Mayflower: MkD For Skyway part, see that series.	Poor	Poor	Good	
Miracle: MpC For Splitro part, see that series.	Poor	Poor	Good	
Nelman: NeC, NlC For Lazear part of NlC, see that series.	Poor	Poor	Fair	
Owen Creek: OcC, OcE For Miracle part, see that series.	Poor	Poor	Good	

Wildlife

Suitability for elements of wildlife habitat—Cont'd.			Suitability for kinds of wildlife			
Shrubs	Wetland plants	Shallow water	Openland	Woodland	Wetland	Rangeland
Fair	Poor	Poor	Poor		Poor	Fair.
Poor	Poor	Very poor	Poor		Very poor	Poor.
Fair	Very poor	Very poor	Very poor		Very poor	Poor.
	Poor	Very poor	Poor	Fair	Very poor	
Fair	Very poor	Very poor	Fair		Very poor	Fair.
Fair	Very poor	Very poor	Poor		Very poor	Fair.
Good	Poor	Very poor	Fair	Good	Very poor	Good.
Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Poor	Poor	Very poor	Very poor		Very poor	Poor.
Fair	Poor	Very poor	Fair	Good	Very poor	
Fair	Very poor	Very poor	Poor	Fair	Very poor	
Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.
Fair	Poor	Very poor	Poor		Very poor	Fair.
Poor	Very poor	Very poor	Poor	Poor	Very poor	Poor.
Poor	Poor	Very poor	Very poor			Poor.
Fair	Poor	Very poor	Fair	Good	Very poor	
Fair	Very poor	Very poor	Poor	Fair	Very poor	
Fair	Poor	Very poor	Poor		Very poor	Fair.
			Good			
Fair	Poor	Poor	Fair		Very poor	Fair.
Fair	Poor	Poor	Very poor		Poor	Poor.
Fair	Poor	Very poor	Poor		Very poor	Fair.
Fair	Poor	Very poor	Poor		Very poor	Fair.
Fair	Poor	Very poor	Poor		Very poor	Fair.
Fair	Poor	Very poor	Fair		Very poor	Fair.
Fair	Poor	Very poor	Fair		Very poor	Fair.
Fair	Poor	Very poor	Fair		Very poor	Fair.
Good	Very poor	Very poor	Poor		Very poor	Good.

TABLE 2

Soil series	Suitability for elements of wildlife habitat			
	Grain and seed	Grass and legumes	Wild herbaceous plants	Coniferous plants
Palma: PaC	Poor	Fair	Fair	
Persayo: PeD	Very poor	Very poor	Poor	
Potts: PoC	Very poor	Poor	Fair	
Rock land: Ro	Very poor	Very poor	Fair	Fair
Rock outcrop: Rp	Very poor	Very poor	Poor	
Scholle: ScC	Poor	Fair	Fair	
Shale outcrop	Very poor	Very poor	Poor	
Skyway.				
2 to 25 percent slope	Poor	Poor	Good	
More than 25 percent slope	Very poor	Very poor	Good	
Splitro	Poor	Poor	Poor	
Stony land: St	Very poor	Very poor	Poor	
Uffens: UfC	Very poor	Very poor	Poor	
Unaweep: UnC	Poor	Poor	Fair	
Utaline: UoD, Us. For Shale outcrop part of Us, see that series.	Very poor	Very poor	Poor	
Wet alluvial land: We	Very poor	Poor	Good	
Witt	Poor	Fair	Fair	
Youngston: Yo	Poor	Poor	Poor	

alkali sacaton, western wheatgrass, winterfat, saltgrass, shadscale, Indian ricegrass, buckwheat, and fringed sage.

Coniferous plants are cone-bearing trees and shrubs that provide cover and frequently furnish food in the form of browse, seeds, or fruitlike cones. They commonly grow in their natural environment, but they may be planted and managed. Typical plants in this category are pine, juniper, and ornamental trees and shrubs.

Shrubs produce buds, twigs, bark, or foliage that are used as food by wildlife or that provide cover and shade for some kinds of wildlife. These plants generally grow in their natural environment. Typical plants in this category are bitterbrush, rabbitbrush, big sagebrush, mountainmahogany, and fruit-producing shrubs.

Wetland plants are annual and perennial herbaceous plants that grow wild on moist and wet sites. They furnish food and cover mostly for wetland wildlife. Typical examples of plants are smartweed, wildmillet, spikerush and other rushes, sedges, burreed, and barnyardgrass. Submerged and floating aquatic plants are not included in this category.

Shallow water includes areas of surface water that have an average depth of less than 5 feet and are useful to wildlife. The areas can be naturally wet areas or those made by dams or levees or by water-control devices in marshes or streams. Typical examples are waterfowl feeding areas, wildlife watering developments, wildlife ponds, and beaver ponds.

The soils also are rated according to their suitability for use as habitat for the four kinds of wildlife in the county.

Openland wildlife includes birds and mammals that use croplands, pasture, meadows, lawns, and areas overgrown with grasses, herbs, shrubs, and vines. Some of these are robin, mourning dove, meadowlark, field sparrow, killdeer, cottontail rabbit, and red fox.

Woodland wildlife includes birds and mammals that use areas of hardwood or coniferous trees and shrubs, or a mixture of both. Some of these are wild turkey, blue grouse, thrushes, vireos, woodpeckers, red squirrel, grey fox, raccoon, mule deer, elk, and black bear.

Wetland wildlife includes birds and mammals that use swampy, marshy, or openwater areas. Some of these are ducks, geese, herons, shore birds, rails, kingfishers, muskrat, and beaver.

Rangeland wildlife includes birds and mammals that use natural range areas. Some of these are ante-

Wildlife—Continued

Suitability for elements of wildlife habitat—cont.			Suitability for kinds of wildlife			
Shrubs	Wetland plants	Shallow water	Openand	Woodland	Wetland	Rangeland
Fair	Very poor	Very poor	Fair		Very poor	Fair.
Poor	Very poor	Very poor	Very poor		Very poor	Poor.
Fair	Poor	Very poor	Poor		Very poor	Fair.
	Very poor	Very poor	Poor	Fair	Very poor	
Poor	Very poor	Very poor	Very poor		Very poor	Poor.
Fair	Poor	Very poor	Fair		Very poor	Fair.
Poor	Very poor	Very poor	Very poor		Very poor	Poor.
Fair	Poor	Very poor	Fair		Very poor	Fair.
Fair	Very poor	Very poor	Poor		Very poor	Fair.
			Poor			
Poor	Very poor	Very poor	Very poor		Very poor	Poor.
Fair	Poor	Poor	Very poor		Very poor	Poor.
Fair	Poor	Very poor	Fair		Very poor	Fair.
Poor	Very poor	Very poor	Very poor		Very poor	Poor.
Fair	Good	Fair	Poor		Fair	Fair.
Poor	Poor	Very poor	Poor		Very poor	Poor.
Poor	Poor	Very poor	Poor		Very poor	Poor.

lope, desert cottontail, chukar, gambel's quail, western meadowlark, and the green-tailed towhee.

Engineering [3]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Properties of soils highly important in engineering include permeability, strength, compaction characteristics, soil drainage, shrink-swell potential, grain size, plasticity, and soil reaction. Also important are depth to the water table, depth to bedrock, and slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables. Table 3 shows several estimated soil properties significant in engineering, and table 4 gives interpretations for various engineering uses.

This information, along with the soil map and other parts of this publication, can be used to make interpre-

[3] LLOYD G. LAUDENSCHLAGER, engineer, Soil Conservation Service, helped prepare this section.

TABLE 3.—*Estimated soil properties*

[Absence of data indicates that the soil is too variable to be rated or that no estimate was made. The symbol > means greater made up of two or more kinds of soil, which may have different properties and limitations. For this

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification		Coarse fraction greater than 3 inches	Percentage < 3 inches passing sieve—		
	Bedrock	Seasonal high water table			Unified	AASHTO		No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)
	In	*Ft*	*In*				*Pct*			
Alluvial land: Ad. Too variable to be estimated.										
Avalon: AvA, AvC.	>60	>6	0–44	Loam	CL–ML, CL	A–4	0	100	90–100	75–90
			44–59	Shale.						
Badland: Ba — Too variable to be estimated.	>12	>6					0			
Bangston — Mapped only with Gateway and Cebone soils.	>5	>6	0–9	Sandy loam	SM	A–2, A–4	0	75–100	75–100	40–70
			9–60	Loamy sand	SM	A–2, A–1	0	75–100	75–100	35–90
Bankard: Bd	>60	>6	0–60	Loamy sand, fine sand.	SP–SM, SM	A–2, A–3	0	95–100	80–100	50–75
Batterson: BrC — Rock outcrop part is too variable to be estimated.	10–20	>6	0–15	Loamy sand	SM	A–2	0–10	75–100	75–100	50–75
			15	Sandstone.						
Billings: Bs	>60	>6	0–60	Silty clay loam.	CL	A–6	0	100	100	95–100
Blackston: BtD	>60	>6	0–14	Gravelly loam.	CL–ML, SM, SC	A–4, A–2	5–25	70–80	55–75	49–55
			14–28	Very gravelly loam.	GM	A–1	25–35	30–50	20–45	20–40
			28–60	Very cobbly sand.	GP	A–1	25–35	30–60	15–50	10–35
Cebone — Mapped only with Gateway and Bangston soils.	20–40	>6	0–24	Loam, fine sand, loam.	SM	A–4	0	75–100	75–100	75–100
			24–38	Clay	CH, CL	A–7	0	75–100	75–100	75–100
			38	Shale.						
Chipeta: ChD	10–15	>6	0–12	Silty clay	CL	A–7, A–6	0	100	100	95–100
			12	Shale.						
Dominguez: DoC.	>4	>6	0–9	Clay loam	CL	A–7, A–6	0	100	95–100	85–90
			9–47	Clay	CH, CL	A–7, A–6	0	100	95–100	85–90
Dwyer: DwC	>60	>6	0–60	Loamy sand	SM	A–2	0	85–100	75–100	50–80
*Fruita: FaC — For Avalon part, see that series.	>60	>6	0–5	Loam	ML, CL–ML	A–4	0–5	90–100	80–100	75–90
			5–60	Clay loam, loam.	CL	A–6	0–5	90–100	90–100	75–90
*Gateway: GcE, GcF. For Bangston and Cebone parts, see those series.	20–40	>6	0–10	Loam	ML	A–4	0	100	90–100	85–100
			10–15	Silty clay loam.	CL	A–6, A–7	0	100	100	95–100
			15–30	Silty clay	CL, CH	A–7	0	100	95–100	90–100
			30	Shale.						

significant in engineering

than; the symbol < means less than. An asterisk in the first column indicates that at least one mapping unit in this series is reason it is necessary to follow carefully the instructions for other series that appear in the first column]

Percentage < 3 inches passing sieve—Cont.	Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity	
								Uncoated steel	Concrete
No. 200 (0.074 mm)	*Pct*		*In/hr*	*In/in of soil*	*pH*	*Mmhos/cm at 25° C*			
50–70	20–30	5–10	0.6–2.0	0.13–0.19	7.9–8.4	2–8	Moderate	High	High.
25–45	NP [1]	NP [1]	2.0–6.0	0.10–0.15	6.6–7.3		Low	Low	Low.
15–25	NP	NP	6.0–20	0.05–0.08	6.6–7.3		Low	Low	Low.
5–25	NP	NP	6.0–20	0.05–0.08	7.9–8.4		Low	Low	Low.
15–25	NP	NP	6.0–20	0.05–0.08	7.9–8.4		Low	Low	Low.
90–95	25–40	11–20	0.06–0.2	0.19–0.21	7.9–8.4	2–8	Moderate	High	High.
20–35	20–25	5–10	0.6–2.0	0.11–0.14	7.9–8.4	0–4	Low	High	Moderate.
10–30	15–20	0–5	2.0–6.0	0.07–0.10	7.9–8.4	4–8	Low	High	Moderate.
0–5	NP	NP	6.0–20	0.03–0.06	7.9–8.4	4–8	Low	High	Moderate.
40–70	15–30	NP–4	0.6–2.0	0.13–0.16	6.6–7.3		Low	Moderate	Low.
60–80	40–60	20–35	0.06–02	0.14–0.17	6.6–7.3		High	Moderate	Low.
90–95	35–45	15–20	0.06–0.02	0.15–0.17	7.9–8.4	8–16	High	High	High.
75–85	35–45	15–35	0.06–0.20	0.15–0.18	7.9–8.4	0–4	High	High	Moderate.
75–85	35–60	15–35	0.06–0.20	0.13–0.15	7.9–8.4	0–4	High	High	Moderate.
15–35	NP	NP	>20	0.08–0.11	7.4–8.4	<2.0	Low	Low	Low.
50–70	20–30	0–10	0.6–2.0	0.15–0.17	7.4–7.8		Low	High	Low.
55–70	25–35	10–15	0.6–2.0	0.15–0.17	7.4–8.4		Low	High	Low.
60–85	30–40	NP–10	0.60–2.0	0.16–0.18	6.1–7.3		Low	High	Low.
85–95	35–50	15–25	0.20–0.6	0.16–0.18	6.1–7.3		Moderate	High	Low.
80–95	40–70	20–35	0.06–0.20	0.14–0.16	6.1–7.3		High	High	Low.

TABLE 3.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification		Coarse fraction greater than 3 inches	Percentage < 3 inches passing sieve—		
	Bedrock	Seasonal high water table			Unified	AASHTO		No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)
	In	*Ft*	*In*				*Pct*			
*Gibbler: GeC — For Witt part, see that series.	20–40	>6	0–6	Fine sandy loam.	ML, SM	A–4	0	75–100	75–100	75–100
			6–20	Clay	CL, CH	A–7	0	75–100	75–100	75–100
			20–26	Clay loam	CL, CH	A–7	0–10	50–75	50–75	50–75
			26	Hard sandstone.						
Glenberg: GlA, GlB.	>60	>6	0–5	Fine sandy loam.	SM	A–4	0	95–100	85–100	75–90
			5–60	Sandy loam	SM	A–2, A–4	0	90–100	75–100	50–70
Gullied land: Gu. Too variable to be estimated.										
Ildefonso: IdC	>60	>6	0–14	Cobbly sandy loam.	SM, GM	A–1	20–30	50–70	45–60	30–45
			14–60	Very cobbly sandy loam.	GM	A–1	40–60	40–60	30–40	20–30
Lazear: LkE — Rock outcrop part is too variable to be estimated.	8–15	>6	0–14	Gravelly loam.	GM	A–4, A–2	0–5	50–75	50–75	40–65
			14	Hard sandstone.						
Loma: Lo	>60	>6	0–5	Loam	ML	A–4	0	75–100	75–100	75–95
			5–28	Silty clay	CL, CH	A–6, A–7	0	75–100	75–100	75–100
			28–40	Silt loam	CL–ML, CL	A–4, A–6	0–5	75–100	75–100	75–95
*Mayflower: MkD — For Skyway part, see that series.	20–40	>6	0–8	Silt loam	ML	A–6, A–4	0	95–100	95–100	85–100
			8–32	Silty clay	CH, CL	A–7	0	95–100	95–100	90–100
			32	Shale.						
*Miracle: MpC — For Owen Creek and Splitro parts, see those series.	20–40	>6	0–4	Fine sandy loam.	SM	A–4	0	80–100	75–100	70–85
			4–30	Sandy clay loam.	SC, CL	A–6	0	80–100	75–100	70–90
			30	Sandstone.						
*Nelman: NeC, NlC. For Lazear part of NlC, see that series.	20–40	>6	0–26	Fine sandy loam.	SM	A–4	0–10	75–100	75–100	60–80
			26	Sandstone.						
*Owen Creek: OcC, OcE. For Miracle parts, see that series.	20–40	>6	0–15	Fine sandy loam.	SM	A–4	0	85–100	75–100	70–85
			15–21	Sandy clay loam.	SC, CL	A–6	0	85–100	75–100	70–90
			21–30	Clay loam	CL, CH	A–7	0	85–100	75–100	75–95
			30	Shale.						
Palma: PaC	>60	>6	0–28	Sandy loam and fine sandy loam.	SM	A–4	0	100	100	70–90
			28–60	Sandy loam	SM	A–2	0	100	100	70–85
Persayo: PeD	10–20	>6	0–16	Silt loam	CL	A–6	0–10	90–100	80–100	80–95
			16	Shale.						

significant in engineering—Continued

Percentage < 3 inches passing sieve—Cont.	Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity	
								Uncoated steel	Concrete
No. 200 (0.074 mm)									
	Pct		*In/hr*	*In/in of soil*	*pH*	*Mmhos/cm at 25° C*			
35–55	15–30	NP–5	0.6–2.0	0.13–0.16	6.6–7.3		Low	Low	Low.
60–80	45–60	20–35	0.06–0.20	0.14–0.17	6.6–7.3		High	Moderate	Low.
45–70	40–60	20–35	0.06–0.20	0.12–0.15	7.9–8.4		High	High	Low.
35–45	NP	NP	2.0–6.0	0.09–0.13	7.9–8.4		Low	Low	Low.
25–40	NP	NP	6.0–20	0.07–0.12	7.9–8.4		Low	Low	Low.
15–25	NP	NP	2.0–6.0	0.06–0.08	7.4–8.4	0–2	Low	High	Low.
10–15	NP	NP	6.0–20	0.06–0.08		2–4			
30–50	20–30	NP–5	0.6–2.0	0.14–0.16	7.9–8.4		Low	High	Low.
55–75	15–25	NP–5	0.6–2.0	0.14–0.18	7.9–8.4		Low	High	Low.
70–95	35–60	15–35	0.06–0.2	0.15–0.17	8.9–8.4		High	High	Low.
70–90	20–40	5–15	0.6–2.0	0.15–0.17	7.9–8.4		Moderate	High	Low.
65–90	30–40	5–15	0.6–2.0	0.16–0.19	6.6–7.3		Low	Moderate	Low.
75–95	40–60	20–35	0.06–0.2	0.15–0.17	6.6–7.8		High	Moderate	Low.
35–50		NP	2.0–6.0	0.12–0.15	6.6–7.3		Low	Moderate	Low.
40–55	25–35	10–15	0.6–2.0	0.14–0.16	6.6–7.3		Low	Moderate	Low.
35–45		NP	6.0–20	0.09–0.14	7.9–8.4		Low	High	Low.
35–50	NP	NP–5	2.0–6.0	0.12–0.15	6.6–7.3		Low	High	Low.
45–60	25–35	10–15	0.6–2.0	0.14–0.16	6.6–7.3		Moderate	High	Low.
70–90	41–55	20–35	0.06–0.2	0.15–0.21	7.4–7.8		High	High	Low.
40–50	NP	NP	2.0–6.0	0.12–0.14	7.4–8.4		Low	Low	Low.
25–35	NP	NP	2.0–6.0	0.08–0.10	7.9–8.4		Low	Moderate	Low.
60–85	25–40	15–20	0.2–0.6	0.15–0.19	7.9–8.4	0–8	Moderate	High	High.

TABLE 3.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification		Coarse fraction greater than 3 inches	Percentage < 3 inches passing sieve—		
	Bedrock	Seasonal high water table			Unified	AASHTO		No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)
	In	*Ft*	*In*				*Pct*			
Potts: PoC	>60	>6	0–4	Sandy loam	SM	A–4	0	75–100	75–100	60–75
			4–18	Clay loam	CL	A–6	0	75–100	75–100	65–95
			18–60	Loam	CL–ML	A–4	0	75–100	75–100	65–95
Rock land: Ro. Too variable to be estimated.										
Rock outcrop: Rp. Too variable to be estimated.										
Scholle: ScC	>60	>6	0–5	Stony loam	ML	A–4	20–30	80–100	75–100	70–95
			5–12	Stony silty clay loam.	CL, SC	A–6	20–30	60–80	50–75	50–75
			12–40	Stony loam	ML	A–4	30–40	60–80	75–100	70–95
Shale outcrop. Mapped only with Utaline soils. Too variable to be estimated.										
Skyway	20–40	>6	0–32	Fine sandy loam.	SM	A–2, A–4	0–10	90–100	75–100	60–80
Mapped only with Mayflower soils.			32	Sandstone.						
Splitro	12–17	>6	0–15	Sandy loam	SM	A–2, A–1	5–10	60–90	60–80	40–60
Mapped only with Miracle soils.			15	Sandstone.						
Stony land: St. Too variable to be estimated.										
Uffens: UfC	>60	>6	0–5	Loam	ML, CL	A–4, A–6	0	100	100	60–75
			5–11	Clay loam	CL	A–6	0	100	100	60–75
			11–16	Loam	ML, CL	A–4, A–6	0	100	100	60–75
			16–50	Fine sandy loam.	ML, CL–ML	A–4	10–20	100	100	60–75
Unaweep: UnC	>60	>6	0–10	Sandy loam, fine sandy loam.	SM	A–4, A–2	0–1	90–100	75–100	60–75
			10–60	Fine sandy loam.	SM	A–4, A–2	0	90–100	75–100	60–80
Utaline: Uod, Us. Shale outcrop part of Us is too variable to be estimated.	>60	>6	0–4	Stony loam	ML, GM	A–4, A–2	15–30	60–90	50–90	40–85
			4–60	Very cobbly loam.	GM	A–2, A–4	25–75	50–75	50–75	40–70

significant in engineering—Continued

Percentage < 3 inches passing sieve—Cont.	Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity	
								Uncoated steel	Concrete
No. 200 (0.074 mm)									
	Pct		*In/hr*	*In/in of soil*	*pH*	*Mmhos/cm at 25° C*			
40–50	NP	NP	2.0–6.0	0.12–0.14	6.3–7.3	<2.0	Moderate	Low	Low.
50–75	30–35	15–20	0.6–2.0	0.19–0.21	6.6–7.8	<2.0	Moderate	Low	Low.
50–75	25–30	5–10	0.6–2.0	0.19–0.21	7.9–8.4	<2.0	Moderate	Moderate	Moderate.
55–75	20–25	NP–5	0.6–2.0	0.13–0.15	6.6–7.3		Low	Moderate	Low.
40–65	30–40	10–15	0.6–2.0	0.13–0.15	7.4–7.8		Moderate	Moderate	Moderate.
50–75	20–25	NP–5	0.6–2.0	0.10–0.12	7.9–8.4		Low	Moderate	Moderate.
30–50	25–35	NP–5	2.0–6.0	0.16–0.18	6.6–7.3		Low	Moderate	Low.
20–30	15–25	NP–5	2.0–6.0	0.11–0.13	6.6–7.3		Low	Low	Low.
55–65	25–40	5–20	0.2–0.6	0.17–0.18	8.5–9.0	15–30	Moderate	High	High.
60–70	25–40	10–20	0.2–0.6	0.17–0.18	8.5–9.0	15–30	Moderate	High	High.
55–65	25–40	5–20	0.2–0.6	0.17–0.18	>9.1	15–30	Moderate	High	High.
50–60	20–25	NP–10	0.2–0.6	0.17–0.18	>9.1	15–30	Moderate	High	High.
30–45	20–30	NP–5	2.0–6.0	0.14–0.16	6.6–7.8		Low	Moderate	Low.
30–50	20–30	NP–5	2.0–6.0	0.12–0.14	7.4–8.4		Low	High	Low.
30–65	20–30	NP–10	2.0–6.0	0.08–0.10	7.9–8.4		Low	Moderate	Low.
30–50	30–50	NP–10	2.0–6.0	0.04–0.08	7.9–8.4		Low	Moderate	Moderate.

TABLE 3.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification		Coarse fraction greater than 3 inches	Percentage < 3 inches passing sieve—		
	Bedrock	Seasonal high water table			Unified	AASHTO		No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)
Wet alluvial land: We. Too variable to be estimated.	>60	>1								
Witt	>60	>6	0–6	Fine sandy loam, loam.	ML, CL–ML	A–4	0	100	100	95–100
Mapped only with Gibbler soils.			6–47	Clay loam, silty clay loam.	CL, ML	A–6	0	100	100	95–100
			47–58	Loam	ML, CL	A–4, A–6	0	100	100	95–100
			58	Sandstone and shale.						
Youngston: Yo	>60	>6	0–4	Loam	CL–ML, CL	A–4	0	90–100	80–100	75–90
			4–8	Sandy loam	SM	A–4, A–2	0	90–100	80–90	60–70
			8–60	Loam, very fine sandy loam.	ML, CL	A–4	0	90–100	80–100	75–90

[1] NP means nonplastic.

tations in addition to those given in tables 3 and 4, and it also can be used to make other useful maps.

This information, however, does not eliminate the need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to a depth greater than shown in the tables, generally a depth of more than 6 feet. Also, inspection of sites, especially the small ones, is needed because many mapped areas of one soil can contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning to soil scientists. The Glossary defines many of these terms.

Classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system used by SCS engineers, the Department of Defense, and others, and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO).

In the Unified system (*2*) soils are classified according to particle size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, CL–ML.

The AASHTO system (*1*) is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade.

Engineering properties

Several estimated soil properties significant in engineering are given in table 3. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 3.

Depth to bedrock is distance from the surface of the soil to the upper surface of the rock layer.

Depth to seasonal high water table is distance from the surface of the soil to the highest level that ground water reaches in the soil in most years.

Soil texture is described in table 3 in the standard

significant in engineering—Continued

Percentage < 3 inches passing sieve—Cont. No. 200 (0.074 mm)	Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity	
								Uncoated steel	Concrete
70–80	20–30	NP–10	0.6–2.0	0.18–0.20	6.6–7.3	----------	Low ------	High -----	Low.
75–85	30–40	10–15	0.6–2.0	0.18–0.20	6.6–8.4	----------	Moderate --	High -----	Low.
70–80	25–40	5–15	0.6–2.0	0.13–0.15	7.9–8.4	----------	Low ------	High -----	Low.
50–70	20–30	5–10	0.6–2.0	0.15–0.17	7.9–8.4	----------	Low ------	High -----	Low.
30–45	15–20	NP–5	2.0–6.0	0.14–0.16	7.9–8.4	----------	Low ------	High -----	Low.
50–70	20–30	5–10	0.6–2.0	0.15–0.17	7.9–8.4	----------	Low ------	High -----	Low.

terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, as for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary of this soil survey.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from semisolid to plastic. If the moisture content is further increased, the material changes from plastic to liquid. The plastic limit is the moisture content at which the soil material changes from semisolid to plastic; and the liquid limit, from plastic to liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic. Liquid limit and plasticity index are estimated in table 3.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 3 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH values. The pH value and terms used to describe soil reaction are explained in the Glossary.

Salinity refers to the amount of soluble salts in the soil. It is expressed as the electrical conductivity of the saturation extract, in mmhos per centimeter at 25° C. Salinity affects the suitability of a soil for crop production, its stability when used as construction material, and its corrosiveness to metals and concrete.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils causes much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Corrosivity pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. Rate of corrosion of uncoated steel is re-

TABLE 4.—*Interpretations of*

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definileast one mapping unit in this series is made up of two or more kinds of soil, which may have different properties and

Soil series and map symbols	Degree and kind of limitation for—			
	Septic tank absorption fields	Sewage lagoons	Dwellings without basements	Roads and streets
Alluvial land: Ad. No interpretations made; properties too variable.				
Avalon: AvA, AvC	Slight where slope is 0 to 8 percent. Moderate where slope is more than 8 percent.[1]	Moderate where slope is 0 to 7 percent: seepage. Severe where slope is more than 7 percent: seepage; slope.	Moderate: shrink-swell; low strength.	Moderate: shrink-swell; low strength.
Badland: Ba. No interpretations made; properties too variable.				
Bangston Mapped only with Gateway and Cebone soils.	Slight where slope is 5 to 8 percent. Moderate where slope is 8 to 15 percent. Severe where slope is more than 15 percent: slope.	Severe: seepage	Slight where slope is 5 to 8 percent: slope. Moderate where slope is 8 to 15 percent: slope. Severe where slope is more than 15 percent: slope.	Slight where slope is 5 to 8 percent. Moderate where slope is 8 to 15 percent: slope. Severe where slope is more than 15 percent: slope.
Bankard: Bd	Severe: floods	Severe: floods; seepage	Severe: floods	Severe: floods
Batterson: BrC Properties too variable to rate for Rock outcrop part.	Severe where slope is 3 to 15 percent: depth to rock. Severe where slope is more than 15 percent; depth to rock: slope.	Severe where slope is 3 to 7 percent: depth to rock; seepage. Severe where slope is more than 7 percent: depth to rock; seepage; slope.	Severe where slope is 3 to 15 percent: depth to rock. Severe where slope is more than 15 percent: depth to rock; slope.	Severe where slope is 3 to 15 percent: depth to rock. Severe where slope is more than 15 percent: depth to rock; slope.
Billings: Bs	Severe: percs slowly	Slight where slope is 0 to 2 percent. Moderate where slope is more than 2 percent.	Severe: floods	Severe: low strength; frost action.
Blackston: BtD	Slight where slope is 3 to 8 percent.[1] Moderate where slope is 8 to 15 percent: slope. Severe where slope is more than 15 percent: slope.	Severe: seepage; slope.	Slight where slope is 3 to 8 percent. Moderate where slope is more than 8 percent: slope.	Slight where slope is 3 to 8 percent. Moderate where slope is more than 8 percent: slope.
Cebone Mapped only with Gateway and Bangston soils.	Severe where slope is 2 to 15 percent: slope; depth to rock; percs slowly. Severe where slope is more than 15 percent: depth to rock; percs slowly; slope.	Severe: depth to rock; slope.	Severe where slope is 2 to 15 percent: shrink-swell; low strength. Severe where slope is more than 15 percent: shrink-swell; slope; low strength.	Severe where slope is 2 to 15 percent: shrink-swell; low strength. Severe where slope is more than 15 percent: shrink-swell; slope.

engineering properties of the soils

tions of "slight," "moderate," "good," "fair," and other terms used to rate soils. An asterisk in the first column indicates that at limitations. For this reason it is necessary to follow carefully the instructions for other series that appear in the first column.]

Degree and kind of limitations for—Continued	Suitability as source of—			Soil features affecting—	
Shallow excavations	Road fill	Sand	Topsoil	Pond reservoir areas	Dikes, levees, and other embankments
Slight where slope is 0 to 8 percent. Moderate where slope is more than 8 percent.	Fair: shrink-swell; low strength.	Unsuited	Good where slope is 0 to 8 percent. Fair where slope is more than 8 percent.	Seepage; slope	Piping, low strength; shrink-swell.
Severe: cutbanks cave.	Good	Fair	Poor: too sandy	Seepage; slope	Seepage; piping.
Severe: floods, cutbanks cave.	Good	Fair	Poor: too sandy	Seepage	Piping; seepage; easily erodible.
Severe where slope is 3 to 15 percent: depth to rock. Severe where slope is more than 15 percent: depth to rock; slope.	Poor: thin layer	Unsuited	Poor: thin layer; small stones.	Depth to rock; slope.	Thin layer.
Moderate: floods	Poor: frost action; low strength.	Unsuited	Fair: too clayey	Favorable where slope is 0 to 2 percent. Fair where slope is more than 2 percent.	Low strength; piping; hard to rock.
Severe: cutbanks cave; small stones.	Good	Fair	Poor: small stones.	Seepage; slope	Seepage; small stones.
Severe where slope is 2 to 15 percent: depth to rock. Severe where slope is more than 15 percent: depth to rock; slope.	Poor: thin layer; low strength; shrink-swell.	Unsuited	Good where slope is 2 to 8 percent. Fair where slope is 8 to 15 percent. Poor where slope is more than 15 percent.	Depth to rock; slope.	Compressible; low strength; shrink-swell.

TABLE 4.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—			
	Septic tank absorption fields	Sewage lagoons	Dwellings without basements	Roads and streets
Chipeta: ChD	Severe where slope is 3 to 15 percent: depth to rock. Severe where slope is more than 15 percent: depth to rock; slope.	Severe where slope is 3 to 7 percent: depth to rock. Severe where slope is more than 7 percent: depth to rock; slope.	Severe where slope is 3 to 15 percent: depth to rock. Severe where slope is more than 15 percent: depth to rock; slope.	Severe where slope is 3 to 15 percent: depth to rock; low strength. Severe where slope is more than 15 percent: slope.
Dominguez: DoC	Severe: percs slowly	Moderate where slope is 3 to 7 percent: slope. Severe where slope is more than 7 percent: slope.	Severe: shrink-swell; low strength.	Severe: shrink-swell; low strength.
Dwyer: DwC	Slight where slope is 3 to 8 percent.[1] Moderate where slope is more than 8 percent: slope.	Severe where slope is 3 to 7 percent: seepage. Severe where slope is more than 7 percent: seepage; slope.	Slight where slope is 3 to 8 percent. Moderate where slope is more than 8 percent: slope.	Slight where slope is 3 to 8 percent. Moderate where slope is more than 8 percent: slope.
*Fruita: FaC For Avalon part, see that series.	Slight where slope is 3 to 8 percent.[1] Moderate where slope is more than 8 percent: slope.	Moderate where slope is 3 to 7 percent: seepage; slope. Severe where slope is more than 7 percent: slope.	Moderate where slope is 3 to 8 percent: low strength. Moderate where slope is more than 8 percent: low strength; slope.	Severe: frost action
*Gateway: GcE, GcF For Bangston and Cebone parts, see those series.	Severe where slope is 2 to 15 percent: depth to rock; percs slowly. Severe where slope is more than 15 percent: depth to rock; percs slowly; slope.	Severe where slope is 2 to 7 percent: depth to rock. Severe where slope is more than 7 percent: depth to rock; slope.	Severe where slope is 2 to 15 percent: shrink-swell; low strength. Severe where slope is more than 15 percent: shrink-swell; slope.	Severe: low strength; shrink-swell.
*Gibbler: GeC For Witt part, see that series.	Severe: depth to rock; percs slowly.	Severe where slope is 3 to 7 percent: depth to rock. Severe where slope is more than 7 percent: depth to rock; slope.	Severe: shrink-swell; low strength.	Severe: shrink-swell; low strength.
Glenberg: GlA, GlB	Severe: floods	Severe: floods; seepage.	Severe: floods	Severe: floods
Gullied land: Gu No interpretations made; properties too variable.				
Ildefonso: IdC	Slight where slope is 3 to 8 percent.[1] Moderate where slope is more than 8 percent: slope.	Severe where slope is 3 to 7 percent: seepage. Moderate where slope is more than 7 percent: seepage; slope.	Slight where slope is 3 to 8 percent. Moderate where slope is more than 8 percent: slope.	Slight where slope is 3 to 8 percent. Moderate where slope is more than 8 percent: slope.
Lazear: LkE No interpretations made for Rock outcrop part; properties too variable.	Severe where slope is 3 to 15 percent: depth to rock. Severe where slope is more than 15 percent: depth to rock; slope.	Severe where slope is 3 to 7 percent: depth to rock. Severe where slope is more than 7 percent: depth to rock; slope.	Severe where slope is 3 to 15 percent: depth to rock. Severe where slope is more than 15 percent: depth to rock; slope.	Severe where slope is 3 to 15 percent: depth to rock. Severe where slope is more than 15 percent: depth to rock; slope.

properties of the soils—Continued

Degree and kind of limitations for—Continued	Suitability as source of—			Soil features affecting—	
Shallow excavations	Road fill	Sand	Topsoil	Pond reservoir areas	Dikes, levees, and other embankments
Severe: depth to rock	Poor: low strength; shrink-swell.	Unsuited	Poor: excess salt; too clayey.	Depth to rock; slope.	Low strength; hard to pack; compressible.
Severe: too clayey	Poor: shrink-swell; low strength.	Unsuited	Poor: too clayey	Slope	Shrink-swell; hard to pack; low strength.
Severe: cutbanks cave.	Good	Fair	Poor: too sandy	Seepage	Seepage; piping.
Slight where slope is 3 to 8 percent. Moderate where slope is more than 8 percent: slope.	Poor: frost action.	Unsuited	Good where slope is 3 to 8 percent. Fair where slope is more than 8 percent: slope.	Seepage; slope	Low strength; piping.
Severe where slope is 2 to 15 percent: too clayey. Severe where slope is more than 15 percent: too clayey; slope.	Poor: low strength; shrink-swell.	Unsuited	Fair where slope is 2 to 15 percent: thin layer. Poor where slope is more than 15 percent: slope.	Slope; depth to rock.	Compressible; shrink-swell; low strength.
Severe: depth to rock	Poor: shrink-swell; thin layer; low strength.	Unsuited	Poor: thin layer	Depth to rock; slope.	Shrink-swell; compressible; low strength.
Severe: floods	Good	Poor	Good	Seepage	Piping.
Severe where slope is 3 to 15 percent: small stones.	Good	Poor	Poor: small stones; excess lime.	Seepage; slope	Favorable.
Severe where slope is 3 to 15 percent: depth to rock. Severe where slope is more than 15 percent: depth to rock; slope.	Poor: thin layer	Unsuited	Poor where slope is 3 to 15 percent: small stones; area reclaim. Poor where slope is more than 15 percent: small stones; area reclaim; slope.	Depth to rock; slope	Thin layer.

TABLE 4.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—			
	Septic tank absorption fields	Sewage lagoons	Dwellings without basements	Roads and streets
Loma: Lo	Severe: percs slowly	Slight where slope is 0 to 2 percent. Moderate where slope is more than 2 percent: slope.	Moderate: low strength; shrink-swell.	Moderate: low strength; shrink-swell; frost action.
*Mayflower: MkD For Skyway part, see that series.	Severe where slope is 5 to 15 percent: percs slowly; depth to rock. Severe where slope is more than 15 percent: percs slowly; depth to rock; slope.	Severe where slope is 5 to 7 percent: depth to rock. Severe where slope is more than 7 percent: depth to rock; slope.	Severe where slope is 5 to 15 percent: shrink-swell; low strength. Severe where slope is more than 15 percent: shrink-swell; low strength; slope.	Severe where slope is 5 to 15 percent: shrink-swell; low strength. Severe where slope is more than 15 percent: shrink-swell; low strength; slope.
*Miracle: MpC For Owen Creek and Splitro parts, see those series.	Severe where slope is 3 to 15 percent: depth to rock.	Severe where slope is 3 to 7 percent: depth to rock. Severe where slope is more than 7 percent: depth to rock; slope.	Moderate where slope is 3 to 8 percent: depth to rock. Moderate where slope is 8 to 15 percent: depth to rock; slope.	Moderate where slope is 3 to 8 percent: depth to rock; frost action. Moderate where slope is 8 to 15 percent: depth to rock; frost action; slope.
*Nelman: NeC, NlC For Lazear part of NlC, see that series.	Severe where slope is 3 to 15 percent: depth to rock. Severe where slope is more than 15 percent: depth to rock.	Severe where slope is 3 to 7 percent: seepage; depth to rock. Severe where slope is more than 7 percent: seepage; depth to rock; slope.	Moderate where slope is 3 to 8 percent: depth to rock. Moderate where slope is 8 to 15 percent: depth to rock; slope.	Moderate where slope is 8 to 15 percent: frost action. Moderate where slope is 8 to 15 percent: frost action; slope. Severe where slope is more than 15 percent: slope.
*Owen Creek: OcC, OcE For Miracle parts, see that series.	Severe where slope is 3 to 15 percent: percs slowly; depth to rock. Severe where slope is more than 15 percent: percs slowly; slope; depth to rock.	Severe where slope is 3 to 7 percent: depth to rock. Severe where slope is more than 7 percent: depth to rock; slope.	Severe where slope is 3 to 15 percent: shrink-swell. Severe where slope is more than 15 percent: shrink-swell; slope.	Slight where slope is 3 to 8 percent. Moderate where slope is 8 to 15 percent: slope. Severe where slope is more than 15 percent: slope.
Palma: PaC	Slight where slope is 3 to 8 percent.[1] Moderate where slope is more than 8 percent.	Severe where slope is more than 3 percent: seepage.	Slight where slope is 3 to 8 percent. Moderate where slope is more than 8 percent: slope.	Moderate where slope is 3 to 8 percent: low strength. Moderate where slope is more than 8 percent: low strength; slope.
Persayo: PeD	Severe where slope is 3 to 15 percent: depth to rock. Severe where slope is more than 15 percent: depth to rock.	Severe where slope is 3 to 7 percent: depth to rock. Severe where slope is more than 7 percent: depth to rock; slope.	Moderate where slope is 3 to 8 percent: shrink-swell; depth to rock. Moderate where slope is 8 to 15 percent: shrink-swell; depth to rock; slope. Severe where slope is more than 15 percent: slope.	Moderate where slope is 3 to 8 percent: shrink-swell; depth to rock. Moderate where slope is 8 to 15 percent: shrink-swell; depth to rock; slope. Severe where slope is more than 15 percent: slope.

properties of the soils—Continued

Degree and kind of limitations for—Continued	Suitability as source of—			Soil features affecting—	
Shallow excavations	Road fill	Sand	Topsoil	Pond reservoir areas	Dikes, levees, and other embankments
Moderate: too clayey	Fair: low strength; frost action; shrink-swell.	Unsuited	Fair: too clayey	Slope	Compressible; low strength.
Severe: depth to rock; too clayey.	Poor: shrink-swell; low strength; thin layer.	Unsuited	Fair where slope is 5 to 8 percent: thin layer. Fair where slope is more than 8 percent: thin layer; slope.	Depth to rock; slope.	Compressible; low strength; shrink-swell.
Severe where slope is 3 to 15 percent: depth to rock.	Poor: thin layer	Unsuited	Good where slope is 3 to 8 percent: slope. Fair where slope is 8 to 15 percent: slope.	Seepage; slope	Thin layer; piping.
Severe where slope is 3 to 15 percent: depth to rock. Severe where slope is more than 15 percent: depth to rock; slope.	Poor where slope is 3 to 25 percent: thin layer. Poor where slope is more than 25 percent: slope; thin layer.	Unsuited	Fair where slope is 3 to 8 percent: area reclaim. Fair where slope is 8 to 15 percent: area reclaim; slope. Poor where slope is more than 15 percent: slope.	Seepage; slope	Piping; thin layer.
Severe where slope is 3 to 15 percent: too clayey. Severe where slope is more than 15 percent: too clayey; slope.	Poor where slope is 3 to 25 percent: thin layer. Poor where slope is more than 25 percent: thin layer; slope.	Unsuited	Fair where slope is 3 to 8 percent: thin layer; too clayey. Fair where slope is 8 to 15 percent: thin layer; too clayey; slope. Poor where slope is more than 15 percent: slope.	Depth to rock; slope.	Low strength; thin layer.
Slight where slope is 3 to 8 percent. Moderate where slope is more than 8 percent: slope.	Fair: low strength.	Poor	Good	Seepage where slope is 3 to 7 percent. Seepage and slope where slope is more than 7 percent.	Piping; low strength.
Moderate where slope is 3 to 8 percent: depth to rock. Moderate where slope is 8 to 15 percent: depth to rock; slope. Severe where slope is more than 15 percent: slope.	Poor where slope is 3 to 25 percent: thin layer.	Unsuited	Poor where slope is 3 to 15 percent: area reclaim. Poor where slope is more than 15 percent: area reclaim; slope.	Slope; depth to rock.	Thin layer; compressible.

TABLE 4.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—			
	Septic tank absorption fields	Sewage lagoons	Dwellings without basements	Roads and streets
Potts: PoC	Moderate where slope is 3 to 8 percent: percs slowly. Moderate where slope is 8 to 15 percent: percs slowly; slope.	Moderate where slope is 3 to 8 percent: seepage; slope. Severe where slope is more than 8 percent: slope.	Moderate where slope is 3 to 8 percent: low strength; shrink-swell. Moderate where slope is more than 8 percent: low strength; shrink-swell; slope.	Severe: frost action.
Rock land: Ro. No interpretations made; properties too variable.				
Rock outcrop: Rp. No interpretations made; properties too variable.				
Scholle: ScC	Moderate where slope is 3 to 8 percent: percs slowly.[1] Moderate where slope is more than 8 percent: percs slowly; slope.	Moderate where slope is 3 to 7 percent: seepage. Severe where slope is more than 7 percent: slope.	Moderate where slope is 3 to 8 percent: shrink-swell. Moderate where slope is more than 8 percent: shrink-swell; slope.	Moderate where slope is 3 to 8 percent: low strength; shrink-swell. Moderate where slope is more than 8 percent: low strength; shrink-swell; slope.
Shale outcrop. Mapped only with Utaline soils. Properties too variable to rate.				
Skyway. Mapped only with Mayflower soils.	Severe where slope is 5 to 15 percent: depth to rock. Severe where solpe is more than 15 percent: depth to rock; slope.	Severe where slope is 5 to 7 percent: depth to rock; seepage. Severe where slope is more than 7 percent: depth to rock; seepage; slope.	Slight where slope is 5 to 8 percent. Moderate where slope is 8 to 15 percent: slope. Severe where slope is more than 15 percent: slope.	Severe where slope is 5 to 15 percent: frost action. Severe where slope is more than 15 percent: frost action; slope.
Splitro. Mapped only with Miracle soils.	Severe where slope is 2 to 15 percent: depth to rock. Severe where slope is more than 15 percent: depth to rock; slope.	Severe where slope is 2 to 7 percent: depth to rock. Severe where slope is more than 7 percent: depth to rock; slope.	Severe where slope is 2 to 15 percent: depth to rock. Severe where slope is more than 15 percent: depth to rock; slope.	Severe where slope is 2 to 15 percent: depth to rock. Severe where slope is more than 15 percent: depth to rock; slope.
Stony land: St. No interpretations made; properties too variable.				
Uffens: UfC	Severe: percs slowly.	Moderate where slope is 3 to 7 percent: slope. Severe where slope is more than 7 percent: slope.	Moderate: frost action; low strength.	Moderate: shrink-swell; frost action; low strength.

properties of the soils—Continued

Degree and kind of limitations for—Continued	Suitability as source of—			Soil features affecting—	
Shallow excavations	Road fill	Sand	Topsoil	Pond reservoir areas	Dikes, levees, and other embankments
Slight where slope is 3 to 8 percent. Moderate where slope is 8 to 15 percent: slope.	Poor: frost action.	Unsuited	Fair: too clayey	Seepage; slope	Hard to pack; low strength.
Moderate where slope is 3 to 8 percent: large stones. Moderate where slope is more than 8 percent: large stones; slope.	Fair: low strength; shrink-swell.	Unsuited	Poor: large stones; thin layer.	Seepage where slope is 3 to 7 percent. Seepage and slope where slope is more than 7 percent.	Compressible; low strength; piping.
Severe: depth to rock	Poor where slope is 5 to 25 percent: thin layer; frost action. Poor where slope is more than 25 percent: thin layer slope; frost action.	Poor	Good where slope is 5 to 8 percent. Fair where slope is 8 to 15 percent: slope. Poor where slope is more than 15 percent: slope.	Seepage; slope; depth to rock.	Thin layer.
Severe where slope is 2 to 15 percent: depth to rock. Severe where slope is more than 15 percent: depth to rock; slope.	Poor: depth to rock.	Unsuited	Poor: thin layer	Depth to rock; slope.	Depth to rock; thin layer.
Slight	Moderate: shrink-swell; frost action; low strength.	Unsuited	Poor: excess salt, excess alkali.	Slope	Piping; low strength; shrink-swell.

TABLE 4.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—			
	Septic tank absorption fields	Sewage lagoons	Dwellings without basements	Roads and streets
Unaweep: UnC	Slight where slope is 3 to 8 percent. Moderate where slope is more than 8 percent: slope.	Severe where slope is 3 to 7 percent: seepage. Severe where slope is more than 7 percent: seepage.	Slight where slope is 3 to 8 percent. Moderate where slope is more than 8 percent: slope.	Severe where slope is more than 3 percent: frost action.
Utaline: UoD, Us. No interpretations made for Shale outcrop part; properties too variable.	Slight where slope is 3 to 8 percent. Moderate where slope is 8 to 15 percent: slope. Severe where slope is more than 15 percent: slope.	Severe where slope is 3 to 7 percent: seepage. Severe where slope is more than 7 percent: seepage; slope.	Slight where slope is 3 to 8 percent. Moderate where slope is 8 to 15 percent: slope. Severe where slope is more than 15 percent: slope.	Slight where slope is 2 to 8 percent. Moderate where slope is 8 to 15 percent: slope. Severe where slope is more than 15 percent: slope.
Wet alluvial land: We	Severe: wetness; floods.	Severe: wetness; floods.	Severe: wetness; floods.	Severe: wetness; floods.
Witt. Mapped only with Gibbler soils.	Slight where slope is 3 to 8 percent. Moderate where slope is more than 8 percent: slope.	Moderate where slope is 3 to 7 percent: slope; seepage. Severe where slope is more than 7 percent: slope.	Slight where slope is 3 to 8 percent. Moderate where slope is more than 8 percent: slope.	Moderate where slope is 3 to 8 percent: low strength; shrink-swell. Moderate where slope is more than 8 percent: low strength; shrink-swell; slope.
Youngston: Yo	Slight[1]	Moderate where slope is 0 to 2 percent: seepage. Moderate where slope is more than 2 percent: seepage.	Moderate: low strength.	Severe: frost action.

[1] Pollution is a hazard in some places because the substratum is permeable.

lated to soil properties such as drainage, texture, total acidity, and electrical conductivity of the soil material. Corrosivity for concrete is influenced mainly by the content of sodium or magnesium sulfate, but also by soil texture and acidity. Installations of uncoated steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. A corrosivity rating of *low* means that there is a low probability of soil-induced corrosion damage. A rating of *high* means that there is a high probability of damage, so that protective measures for steel and more resistant concrete should be used to avoid or minimize damage.

Engineering interpretations

The estimated interpretations in table 4 are based on the engineering properties of soils shown in table 3, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of Mesa County Area. Table 4 gives ratings that summarize the limitation or suitability of the soils for the listed purposes. It also lists those soil features not to be overlooked in the planning, installation, and maintenance of pond reservoir areas and dikes, levees, and embankments.

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means soil properties are generally favorable for the rated use, or in other words, limitations that are minor and easily overcome. *Moderate* means that some soil properties are not favorable but can be overcome or modified by special planning and design. *Severe* means soil properties are so unfavorable and so difficult to correct or overcome as to require major soil reclamation and special designs.

Soil suitability is rated by the terms *good, fair,* and *poor.* They have meanings approximately parallel to the terms slight, moderate, and severe.

Following are explanations of the column headings in table 4.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material from

properties of the soils—Continued

Degree and kind of limitations for—Continued	Suitability as source of—			Soil features affecting—	
Shallow excavations	Road fill	Sand	Topsoil	Pond reservoir areas	Dikes, levees, and other embankments
Slight where slope is 0 to 8 percent. Moderate where slope is more than 8 percent: slope.	Severe: frost action.	Poor	Good where slope is 3 to 8 percent. Fair where slope is more than 8 percent: slope.	Seepage; slope	Piping.
Severe where slope is 2 to 15 percent: small stones. Severe where slope is more than 15 percent: slope.	Good where slope is 3 to 15 percent. Fair where slope is more than 15 percent: slope.	Poor	Poor where slope is 3 to 15 percent: small stones. Poor where slope is more than 15 percent: small stones; slope.	Seepage; slope	Large stones.
Severe: wetness	Poor: wetness; floods.	Unsuited	Fair: wetness; floods.	Wetness; floods	Wetness.
Moderate: too clayey	Fair: low strength; shrink-swell.	Unsuited	Fair where slope is 3 to 8 percent: slope; too clayey. Fair where slope is more than 8 percent: too clayey; slope.	Seepage; slope	Low strength; piping: shrink-swell.
Slight	Poor: frost action.	Unsuited	Good	Seepage	Low strength.

a depth of 18 inches to 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope is a soil property that affects difficulty of layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor, and sides, or embankments, of compacted soil material. The assumption is made that the embankment is compacted to medium density and the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, organic matter, and slope, and if the floor needs to be leveled, depth to bedrock becomes important. The soil properties that affect the embankment are the engineering properties of the embankment material as interpreted from the Unified Soil Classification and the amounts of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Dwellings without basements are not more than three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement under load, and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Roads and streets, as rated in table 4, have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordi-

nary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

Shallow excavations are those that require digging or trenching to a depth of less than 6 feet, as for example, excavations for pipelines, sewer lines, phone and power transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or big stones, and freedom from flooding or a high water table.

Soil properties that most affect design and construction of roads and streets are load supporting capacity and stability of the subgrade, and the workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material, and also the shrink-swell potential, indicate traffic supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade. Road fill is soil material used in embankments for roads. The suitability ratings reflect (1) the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and (2) the relative ease of excavating the material at borrow areas.

Sand is used in great quantities in many kinds of construction. The ratings in table 4 provide guidance about where to look for probable sources. A soil rated as a *good* or *fair* source of sand generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the material, and neither do they indicate quality of the deposit.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for preparing a seedbed; natural fertility of the material, or its response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability, but also considered in the ratings is damage that will result at the area from which topsoil is taken.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Dikes, levees, and other embankments require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are among factors that are unfavorable.

Formation and Classification of the Soils

In this section, the factors that affect the formation of soils are discussed. The soil series of the county are placed in the higher categories of soil classification, and these categories are defined.

Formation of the Soils

Soil is composed of mineral matter mixed with varying amounts of organic matter derived mostly from vegetation. The mineral matter is derived from parent material that has been weathered and broken down by the combined effect of climate, living organisms, and topography through long periods of time. Within short distances, the combination of these factors varies, and consequently the soils have different fertility, productivity, and physical and chemical characteristics.

Parent material

Many soils in the Mesa County Area formed in residuum that weathered from sandstone or shale. Some soils formed in alluvium that was derived from sandstone and shale deposited in the major valleys and on bordering uplands. Several soils formed in sandy wind-deposited materials. Soils that formed in weathered sandstone, such as those in the Nelman series, are generally sandy. The clay these soils contain was an impurity in the sandstone that was released by weathering. Soils that formed in shale, such as those in the Chipeta series, are clayey because clay is the basic constituent of shale. Soils that formed in mixed alluvium derived from sandstone and shale, such as those in the Loma series, are loamy. Some of the soils in the county have acquired excess salt and sodium from the parent material.

Climate

Climate is an active part of the formation of soils. It is determined mainly by temperature and precipitation. Erosion and alternate freezing and heating break rocks down into small fragments. The weathered material is further broken down by chemical reactions such as solution and hydration. In this county, precipitation ranges from about 8 to 24 inches. Soils of the Entisol order, such as those in the Persayo series, are in the driest and warmest areas of the county. Soils of the Mollisol order, such as those in the Mayflower series, are in the cooler, wetter parts.

Living organisms

Living organisms also are active in the formation of soils. Organic matter is the main source of the dark color in soils. Fungi and algae are among the earliest inhabitants of rock material, and they help break down the rock. As the rock weathers, grasses, shrubs, and trees are able to grow and support animal life.

The kinds of plants and animals present largely determine the kinds and amount of organic matter added to the soil and how this matter is incorporated with the mineral part of the soil. Roots, rodents, and insects penetrate the soil and influence its structure. Leaves, roots, and whole plants that stay in the surface layer are changed to humus by micro-organisms, chemicals, and insects.

The plants in Mesa County range from desert shrubs and grasses to ponderosa pine, juniper, and pinyon trees in the valleys, lower mountains, and foothills.

Spruce and fir trees are the main plants in the higher mountain areas. Common rodents are gophers, prairie dogs, badgers, rabbits, and marmots. Pebbles and stones on the surface of terraces and in many other areas have been dug up by burrowing rodents.

Topography

Topography, or relief, is determined by the resistance of bedrock to erosion by water and soil blowing. In the eroded uplands of the county, runoff water has carved deep valleys that have many branches into the original bedrock. The rugged relief contrasts sharply with the smooth low relief of the terraces and flood plains of the river valleys.

In the uplands the number and the distinctness of soil horizons decrease as slope increases. Steep soils that have rapid runoff have many characteristics similar to those of soils formed in arid climates. Level soils that receive runoff water from overlying areas have many of the characteristics of soils that formed in a humid climate. Examples of this pattern are the shallow Batterson soil that is steep and the deep Loma soil in swales and depressions. The Batterson soil has no B horizon, but the Loma soil has a B horizon 10 to 15 inches thick.

Time

The changes that take place in a soil over long periods give the soil distinct horizons, or layers, by which it can be recognized. The kind and arrangement of horizons are called soil morphology and can be described in terms of color, texture, structure, consistence, and thickness.

The length of time a soil has been forming is determined in part from the thickness of the A horizon, the content of organic matter and of clay, the depth to which soluble material is leached, and the form and distribution of calcium carbonate and gypsum in the soil.

Billings silty clay loam, a soil of the Entisol order, is an example of a young soil. It is on a flood plain adjacent to streams. The content of organic matter is not enough for an A horizon to form, there is no layer of clay accumulation, and little translocation of carbonates has occurred so that B2 and Cca horizons could form.

The Loma soils formed in parent material similar to, but much older than, that of Billings silty clay loam. Loma soils formed in alluvium on uplands and are in the Mollisol order. They contain enough organic matter to have a dark A horizon. Also, they have distinct clay accumulation in the B2t horizon, and very distinct accumulation of carbonates in the lower part of the subsoil and the substratum.

Classification of Soils

Soils are classified to show their significant characteristics. Classification helps to assemble knowledge about the soils, to see the relationship of one soil to another and to the whole environment, and to develop principles for understanding their behavior and response to manipulation. First through classification, and then through use of soil maps, knowledge of soils can be applied to specific fields and other tracts of land (*3, 4, 5*).

The narrow categories of classification, such as those used in detailed soil surveys, help to organize and apply knowledge about soils in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes for study and comparison of large areas as countries and continents.

The system of soil classification currently used (*7*) was adopted by the National Cooperative Soil Survey in 1965. Because this system is under continual study, readers interested in developments of the current system should search the latest literature available.

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped. In table 5, the soil series of Mesa County Area are placed in categories of the current system. They are briefly defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates. Each order is named with a word of three or four syllables ending in *sol* (Ent-i-sol).

SUBORDER. Each order is subdivided into suborders that are based primarily on those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging, or soil differences resulting from the climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order.

GREAT GROUP. Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and thick, dark-colored surface horizons. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors associated with basic rocks, and the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder.

SUBGROUP. Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others called intergrades that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of sub-

TABLE 5.—*Classification of the soils*

Series	Family	Subgroup	Order
Avalon	Fine-loamy, mixed, mesic	Typic Calciorthids	Aridisols.
Bangston	Sandy, mixed	Typic Cryoborolls	Mollisols.
Bankard	Sandy, mixed, mesic	Ustic Torrifluvents	Entisols.
Batterson	Sandy, mixed, mesic	Lithic Ustic Torriorthents	Entisols.
Billings	Fine-silty, mixed, (calcareous), mesic	Typic Torrifluvents	Entisols.
Blackston	Loamy-skeletal, mixed, mesic	Typic Calciorthids	Aridisols.
Cebone	Fine, montmorillonitic	Boralfic Cryoborolls	Mollisols.
Chipeta	Clayey, mixed, (calcareous), mesic, shallow	Typic Torriorthents	Entisols.
Dominguez	Fine, montmorillonitic, mesic	Ustertic Camborthids	Aridisols.
Dwyer	Mixed, mesic	Ustic Torripsamments	Entisols.
Fruita	Fine-loamy, mixed, mesic	Typic Haplargids	Aridisols.
Gateway	Fine, montmorillonitic	Typic Cryoboralfs	Alfisols.
Gibbler	Fine, montmorillonitic, mesic	Ustollic Paleargids	Aridisols.
Glenberg	Coarse-loamy, mixed, (calcareous), mesic	Ustic Torrifluvents	Entisols.
Ildefonso	Loamy-skeletal, mixed, mesic	Ustollic Calciorthids	Aridisols.
Lazear	Loamy, mixed, (calcareous), mesic	Lithic Ustic Torriorthents	Entisols.
Loma	Fine, montmorillonitic, mesic	Aridic Argiustolls	Mollisols.
Mayflower	Fine, montmorillonitic	Argic Pachic Cryoborolls	Mollisols.
Miracle	Fine-loamy, mixed	Argic Cryoborolls	Mollisols.
Nelman	Coarse-loamy, mixed, (calcareous), mesic	Ustic Torriorthents	Entisols.
Owen Creek	Fine, montmorillonitic	Argic Cryoborolls	Mollisols.
Palma	Coarse-loamy, mixed, mesic	Ustollic Haplargids	Aridisols.
Persayo	Loamy, mixed, (calcareous), mesic, shallow	Typic Torriorthents	Entisols.
Potts	Fine-loamy, mixed, mesic	Ustollic Haplargids	Aridisols.
Scholle	Fine-loamy, mixed, mesic	Ustollic Haplargids	Aridisols.
Skyway	Coarse-loamy, mixed	Pachic Cryoborolls	Mollisols.
Splitro	Loamy, mixed	Lithic Cryoborolls	Mollisols.
Uffens	Fine-loamy, mixed, mesic	Typic Natrargids	Aridisols.
Unaweep	Coarse-loamy, mixed, mesic	Aridic Haplustolls	Mollisols.
Utaline	Loamy-skeletal, mixed, mesic	Typic Calciorthids	Aridisols.
Witt	Fine-silty, mixed, mesic	Ustollic Haplargids	Aridisols.
Youngston	Fine-loamy, mixed, (calcareous), mesic	Typic Torrifluvents	Entisols.

groups are derived by placing one or more adjectives before the name of the great group.

FAMILY. Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reactions, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on, that are used as family differentiae.

General Nature of the Area

Mesa County is in the Canyon Lands and Uinta Basin sections of the Colorado Plateau physiographic province. The major physiographic features in the area are the Grand Valley, the Little Book Cliffs, Grand Mesa, Plateau Valley, the Uncompahgre Plateau, and the Dolores River Valley. The high escarpment formed by the Little Book Cliffs and the west end of Grand Mesa extends from northwest to southeast across the middle of the county and marks the northern boundary of the Canyon Lands section and the southern boundary of the Uinta Basin section. Total relief within the county is about 6,900 feet. Altitude ranges from about 4,300 feet along the Colorado River at the west edge of the county to 11,234 feet at Leon Peak on Grand Mesa.

Mesa County is drained by the Colorado River and its tributaries. The Colorado River enters the county along the northern edge near the town of De Beque and within a few miles enters the deep De Beque Canyon, which cuts through the plateau at the eastern end of the Little Book Cliffs. The Colorado River emerges from De Beque Canyon just above the town of Palisade and crosses the Grand Valley for a distance of about 13 miles to the city of Grand Junction, where it is joined by the Gunnison River. The Colorado then turns abruptly northwestward and follows the southern margin of the Grand Valley for about 18 miles. Below Fruita it leaves the Grand Valley and cuts across the northern end of the Uncompahgre Plateau.

The southeastern and east-central parts of Mesa County are drained by the Gunnison River and its tributaries. Most of the northeastern part of the county is drained by Plateau Creek, which joins the Colorado River in De Beque Canyon. The southwestern part of the county is drained by the Dolores River and the Little Dolores River and their tributaries. Both of these streams join the Colorado River in Utah several miles west of the Colorado State line.

The Grand Mesa National Forest, though not in the Mesa County Area, is close enough to be of economic and recreational value. This forest is on Grand Mesa, a high plateau about 5,000 feet above the Grand Valley. The National Forest covers 679,804 acres and includes 225 reservoirs and natural lakes that supply Grand Junction, Fruita, Palisade, and other towns with ex-

cellent drinking water and some water for irrigation.

Ranchers can get permits from the government to graze livestock in the national forest. Sportsmen have access to 166 miles of streams and 60 lakes.

The Mesa County Area was Ute Indian territory until 1881. In that year immigrants entered the Grand Valley. The townsite for Grand Junction was established on September 26, 1881. On February 14, 1883 the area that now makes up Mesa County was taken from the western part of Gunnison County and organized as a political unit.

The farming development of the Grand Valley began with the completion of the first system of irrigation canals in 1885. By 1890, the population had increased to 4,260, and by 1900 to 9,267. The settlers came largely from Kansas, Nebraska, Missouri, other Central States, and Texas.

Grand Junction, population 20,840, is the county seat and largest town. Mesa County had a population of 55,287 in 1972.

Climate

The Mesa County Area has a rather wide range of climate. In the desert part, average annual precipitation ranges from 8 to 10 inches; summers are hot, winters are moderate, and the frost-free season ranges to 175 days. In the foothills, average annual precipitation ranges from 10 to 16 inches; summers are warm, winters are cool, and the frost-free season ranges from 100 to 125 days. In the mountains and Subalpine area, annual precipitation ranges from 16 to 24 inches and is mostly snow. These areas have cool summers and cold winters and a frost-free season that ranges from 35 to 75 days in the Subalpine area and from 75 to 125 days in the lower mountains.

Temperature generally decreases with increasing elevation, but the temperature at night is often lower along river valleys than at the higher places that have more cold air movement. Daytime temperatures vary 2° to 5° for each thousand feet difference in elevation and are largely affected by local terrain.

A summary of temperature and precipitation data from the Colorado National Monument station is given in table 6. Table 7 gives the probabilities of the last freezing temperatures in spring and the first in fall at the same station.

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[4] Tables 6 and 7 were prepared by J. W. BERRY, climatologist for Colorado, National Weather Service, U.S. Department of Commerce.

Glossary

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Area reclaim. Borrow areas are difficult to reclaim, and revegetation and erosion control on these areas are extremely difficult.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Channery soil. A soil that contains thin, flat fragments of sandstone, limestone, or schist, as much as 6 inches in length along the longer axis. A single piece is called a fragment.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Climax vegetation. The stabilized plant community on a particular site; it reproduces itself and does not change so long as the environment does not change.

Complex slopes. Short and irregular slopes. Planning and construction of terraces, diversions, and other water-control measures are difficult.

Compressible. The soil is relatively soft and decreases excessively in volume when a load is applied.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Corrosive. The soil has high potential for causing uncoated steel to corrode or concrete to deteriorate.

Cutbanks cave. Walls of cuts are not stable. The soil sloughs easily.

Deferred grazing. The practice of delaying grazing until range

TABLE 6.—*Temperature and precipitation data*

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 have at least 4 days with—		Average total	One year in 10 have—		Average number of days with snow cover of 0.1 inch or more	Average depth of snow on days with snow cover of 0.1 inch or more
			Maximum temperatures equal to or higher than—	Minimum temperatures equal to or lower than—		Less than—	More than—		
	°F	°F	°F	°F	In	In	In		In
January	37	19	48	4	0.95	0.3	1.8	14	5
February	42	23	54	9	.80	.4	1.5	9	7
March	51	29	65	16	1.01	.2	1.9	3	3
April	63	39	77	26	.93	.4	1.8	(1)	2
May	75	48	86	35	.73	.3	1.4	0	0
June	85	57	96	43	.69	.1	1.5	0	0
July	92	64	98	56	.73	.3	1.3	0	0
August	88	61	97	53	1.56	.1	2.4	0	0
September	80	54	92	41	.86	.1	2.1	0	0
October	67	43	79	31	1.10	.1	2.4	(1)	2
November	49	29	63	18	.81	.2	1.7	2	3
December	39	22	51	8	.70	.2	1.5	10	4
Year	64	41	[2] 99	[3] 0	10.87	7.0	15.0	38	5

[1] Less than one-half day. [2] Average annual highest temperature. [3] Average annual lowest temperature.

plants have reached a definite stage of growth, in order to increase the vigor of the forage and to allow the desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Depth to rock. Bedrock is so near the surface that it affects specified use of the soil.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low available water capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Excess alkali. Exchangeable sodium imparts poor physical properties that restrict the growth of plants.

Excess fines. The soil contains too much silt and clay for use as gravel or sand in construction.

Excess lime. The amount of carbonates in the soil is so high that it restricts the growth of some plants.

Excess salt. The amount of soluble salt in the soil is so high that it restricts the growth of most plants.

Fast intake. Water infiltrates rapidly into the soil.

Favorable. Features of the soil are favorable for the intended use.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has been allowed to drain away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Frost action. Freezing and thawing may damage structures.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rains. The distinction between gully and rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by normal tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage. V-shaped gullies result if the material is more difficult to erode with depth; whereas U-shaped gullies result if the lower material is more easily eroded than that above it.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumula-

TABLE 7.—*Probability of last freezing temperatures in spring and first in fall*

[Elevation 5,780 feet]

Probability	Dates for given probability and temperature				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than	March 28	April 3	April 16	May 5	May 17
2 years in 10 later than	March 22	March 29	April 10	April 29	May 11
5 years in 10 later than	March 11	March 17	March 29	April 18	April 30
Fall:					
1 year in 10 earlier than	November 8	November 2	October 26	October 12	October 4
2 years in 10 earlier than	November 14	November 8	November 1	October 18	October 10
5 years in 10 earlier than	November 25	November 19	November 12	October 29	October 21

tion of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to relatively level plots surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops, or in orchards, to confine the flow of water to one direction.

Furrow.—Water is applied in small ditches made by cultivation implements used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Irrigation water, released at high points, flows onto the field without controlled distribution.

Large stones. Rock fragments 10 inches or more across affect the specified use.

Low strength. The soil has inadequate strength to support loads.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Percs slowly. Water moves through the soil slowly, affecting the specified use.

Permafrost. The soil contains frozen layers throughout the year.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Piping. The soil is susceptible to the formation of tunnels or pipelike cavities by moving water.

Pitting. The soil is susceptible to the formation of pits caused by the melting of ground ice when the plant cover is removed.

Poor outlets. Surface or subsurface drainage outlets are difficult or expensive to install.

Range condition. The state of health or productivity of both soil and forage in a given range, in terms of what productivity could or should be under normal climate and the best practical management. Condition classes generally recognized are—*excellent, good, fair,* and *poor.* The classification is based on the percentage of original, or climax, vegetation on the site, as compared to what ought to grow on it if management were good.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rooting depth. A layer that greatly restricts the downward rooting of plants occurs at a shallow depth.

Saline soil. A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Seepage. Water moves through the soil so quickly that it affects the specified use.

Shrink-swell. The soil expands on wetting and shrinks on dry-

ing, which may cause damage to roads, dams, building foundations, or other structures.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slow intake. Water infiltrates slowly into the soil.

Slow refill. Ponds fill slowly because the permeability of the soil is restricted.

Small stones. Rock fragments that are less than 10 inches across may affect the specified use.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles) adhering together without any regular cleavage, as in many claypans and hardpans).

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Thin layer. Suitable soil material is not thick enough for use as borrow material or topsoil.

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Unstable fill. Banks of fill are likely to cave in or slough.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. In referring to a capability unit or range site, read the introduction to the section it is in for general information about its management.

Map symbol	Mapping unit	Page	Capability unit Symbol	Capability unit Page	Range site Name	Range site Page
Ad	Alluvial land	4	VIIIw-1	23	----------	--
AvA	Avalon loam, 0 to 3 percent slopes	5	VIe-1	22	Loamy Salt Desert	25
AvC	Avalon loam, 3 to 12 percent slopes	5	VIe-1	22	Loamy Salt Desert	25
Ba	Badland	5	VIIIe-1	23	----------	--
Bd	Bankard loamy sand	6	VIIw-1	23	Salt Flats	24
BrC	Batterson-Rock outcrop complex, 3 to 12 percent slopes	6	VIIe-1	23	----------	--
Bs	Billings silty clay loam	7	IIs-1 irrigated VIIs-2 nonirrigated	22 23	Salt Flats	24
BtD	Blackston stony loam, 3 to 25 percent slopes	7	VIe-1	22	Loamy Salt Desert	25
ChD	Chipeta silty clay, 3 to 25 percent slopes	8	VIIe-1	23	Clayey Salt Desert	24
DoC	Dominguez clay loam, 3 to 12 percent slopes	9	VIe-2	22	Clayey Foothills	26
DwC	Dwyer loamy sand, 3 to 12 percent slopes	9	VIe-2	22	Sandy Foothills	26
FaC	Fruita-Avalon association, undulating	9	VIe-1	22	Loamy Salt Desert	25
GcE	Gateway-Cebone-Bangston association, steep	11	VIe-3	23	----------	--
GcF	Gateway-Cebone-Bangston association, very steep	11	VIIe-2	23	----------	--
GeC	Gibbler-Witt association, undulating	11	VIe-2	22	Loamy Foothills	26
GlA	Glenberg sandy loam, 0 to 3 percent slopes	12	IIe-1 irrigated VIe-2 nonirrigated	22 22	Sandy Foothills	26
GlB	Glenberg sandy loam, 3 to 8 percent slopes	12	VIe-2	22	Sandy Foothills	26
Gu	Gullied land	12	VIIIe-1	23	----------	--
IdC	Ildefonso cobbly sandy loam, 3 to 12 percent slopes	12	VIIe-1	23	Stony Salt Desert	25
LkE	Lazear-Rock outcrop complex, 3 to 30 percent slopes	13	----------	--	----------	--
	Lazear gravelly loam	--	VIIe-1	23	Loamy Salt Desert	25
	Rock outcrop	--	----------	--	----------	--
Lo	Loma loam	13	VIe-2	22	Loamy Foothills	26
MkD	Mayflower-Skyway association, rolling	14	VIe-2	22	Subalpine Loam	28
MpC	Miracle-Splitro association, undulating	14	VIe-2	22	Mountain Loam	27
NeC	Nelman sandy loam, 3 to 12 percent slopes	15	VIe-1	22	Loamy Salt Desert	25
NlC	Nelman-Lazear sandy loams, 3 to 12 percent slopes	15	VIe-1	22	Loamy Salt Desert	25
OcC	Owen Creek-Miracle complex, 3 to 12 percent slopes	15	VIe-2	22	Mountain Loam	27
OcE	Owen Creek-Miracle complex, 12 to 30 percent slopes	15	VIe-2	22	Mountain Loam	27
PaC	Palma sandy loam, 3 to 12 percent slopes	16	IVe-1 irrigated VIe-2 nonirrigated	22 22	Loamy Foothills	26
PeD	Persayo silt loam, 3 to 25 percent slopes	16	VIIe-1	23	Silty Salt Desert	24
PoC	Potts sandy loam, 3 to 12 percent slopes	17	IVe-1 irrigated VIe-2 nonirrigated	22 22	Loamy Foothills	26
Ro	Rock land	17	VIIs-1	23	----------	--
Rp	Rock outcrop	17	VIIIs-1	23	----------	--
ScC	Scholle stony loam, 3 to 12 percent slopes	17	VIe-2	22	Loamy Foothills	26
St	Stony land	18	VIIs-1	23	----------	--
UfC	Uffens loam, 3 to 12 percent slopes	19	VIIe-1	23	Salt Flats	24
UnC	Unaweep sandy loam, 3 to 12 percent slopes	19	IVe-1 irrigated VIe-2 nonirrigated	22 22	Loamy Foothills	26
UoD	Utaline stony loam, 3 to 25 percent slopes	20	VIIe-1	23	Stony Salt Desert	25
Us	Utaline-Shale outcrop complex	20	----------	--	----------	--
	Utaline stony loam	--	VIIe-1	23	Stony Salt Desert	25
	Shale outcrop	--	----------	--	----------	--
We	Wet alluvial land	20	Vw-1	22	Mountain Meadow	28
Yo	Youngston loam	21	VIe-1	22	Loamy Salt Desert	25

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

COLORADO AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

MESA COUNTY AREA, COLORADO

Scale 1:380,160
1 0 1 2 3 4 5 6 Miles

N

SOIL ASSOCIATIONS

1 — Fruita-Avalon association: Deep, nearly level to rolling, well-drained loam soils that formed in sediments from sedimentary rocks; on fans, benches, and high terraces

2 — Persayo-Badland-Chipeta association: Shallow, gently sloping to steep, well-drained silty clay and silt loam soils that formed in residuum from shale and in rolling to very steep badlands; on uplands

3 — Utaline-Nelman-Lazear association: Deep to shallow, gently sloping to steep, well-drained stony loam, sandy loam, and gravelly loam soils that formed in materials weathered from basalt and sandstone; on high terraces, upland hills, and ridges

4 — Rock outcrop-Palma-Potts association: Steep and very steep rock outcrop, and gently sloping to rolling, deep, well-drained sandy loam soils that formed in aeolian deposits; on uplands

5 — Owen Creek-Miracle association: Moderately deep, gently sloping to steep, well-drained fine sandy loam soils that formed in residuum from sandstone and shale; on mountain slopes, ridges, and mesas

6 — Mayflower-Cebone-Bangston association: Deep and moderately deep, gently sloping to steep, well-drained silt loam, loam, and sandy loam soils that formed in sediments weathered from sandstone and shale; on mountain slopes and ridges

7 — Ildefonso-Scholle-Stony land association: Deep, gently sloping to rolling, well-drained cobbly sandy loam and stony loam soils that formed in sediments from mixed rocks and in moderately steep or steep stony land; on fans and upland slopes

Compiled 1974

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

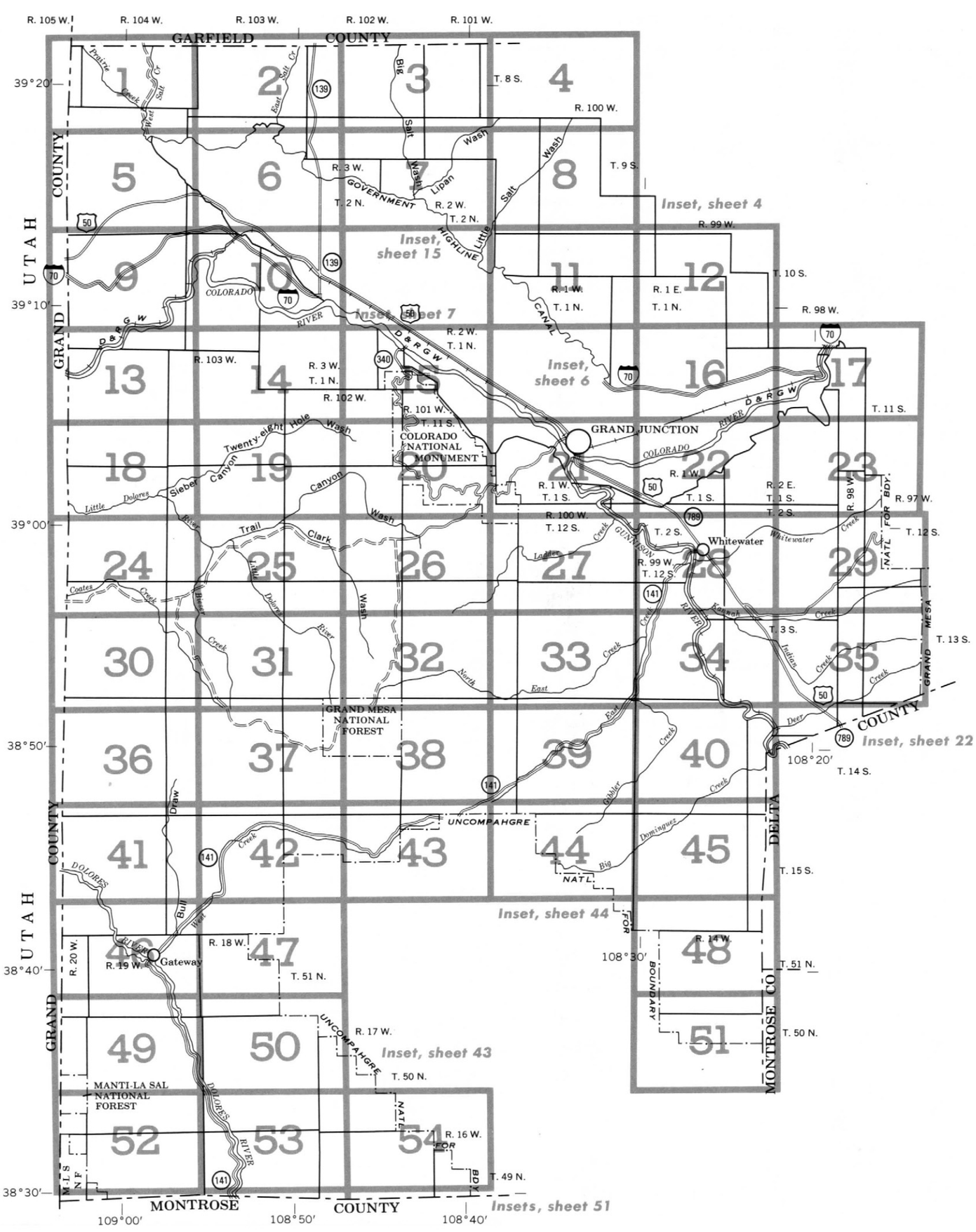
INDEX TO MAP SHEETS

MESA COUNTY AREA, COLORADO

Scale 1:380,160

1 0 1 2 3 4 5 6 Miles

N



SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, shows the slope. Most symbols without a slope letter are those of nearly level soils, but some are for land types that have a considerable range of slope.

SYMBOL	NAME
Ad	Alluvial land
AvA	Avalon loam, 0 to 3 percent slopes
AvC	Avalon loam, 3 to 12 percent slopes
Ba	Badland
Bd	Bankard loamy sand
BrC	Batterson-Rock outcrop complex, 3 to 12 percent slopes
Bs	Billings silty clay loam
BtD	Blackston stony loam, 3 to 25 percent slopes
ChD	Chipeta silty clay, 3 to 25 percent slopes
DoC	Dominguez clay loam, 3 to 12 percent slopes
DwC	Dwyer loamy sand, 3 to 12 percent slopes
FaC	Fruita-Avalon association, undulating
GcE	Gateway-Cebone-Bangston association, steep
GcF	Gateway-Cebone-Bangston association, very steep
GeC	Gibbler-Witt association, undulating
GlA	Glenberg sandy loam, 0 to 3 percent slopes
GlB	Glenberg sandy loam, 3 to 8 percent slopes
Gu	Gullied land
IdC	Ildefonso cobbly sandy loam, 3 to 12 percent slopes
LkE	Lazear-Rock outcrop complex, 3 to 30 percent slopes
Lo	Loma loam
MkD	Mayflower-Skyway association, rolling
MpC	Miracle-Splitro association, undulating
NeC	Nelman sandy loam, 3 to 12 percent slopes
NlC	Nelman-Lazear sandy loams, 3 to 12 percent slopes
OcC	Owen Creek-Miracle complex, 3 to 12 percent slopes
OcE	Owen Creek-Miracle complex, 12 to 30 percent slopes
PaC	Palma sandy loam, 3 to 12 percent slopes
PeD	Persayo silt loam, 3 to 25 percent slopes
PoC	Potts sandy loam, 3 to 12 percent slopes
Ro	Rock land
Rp	Rock outcrop
ScC	Scholle stony loam, 3 to 12 percent slopes
St	Stony land
UfC	Uffens loam, 3 to 12 percent slopes
UnC	Unaweep sandy loam, 3 to 12 percent slopes
UoD	Utaline stony loam, 3 to 25 percent slopes
Us	Utaline-Shale outcrop complex
We	Wet alluvial land
Yo	Youngston loam

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Soil survey
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
- Unclassified

Canals and ditches, irrigation

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

Short steep slope

Prominent peak

Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Solonetz spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully
- Saline spot

MESA COUNTY AREA, COLORADO NO. 1

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Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.
Land division corners are approximately positioned on this map.

MESA COUNTY AREA, COLORADO — SHEET NUMBER 1

R. 105 W. | R. 104 W.
1 000 000 FEET

580 000 FEET

T. 9 S. | T. 8 S.

GARFIELD COUNTY

GRAND COUNTY

UTAH

Prairie Creek

West Salt Creek

Badger Wash

G.P.

Ba Bd Bs ChD FaC PeD Ro AvC

13 18 17 16 15 14 13
24 19 20 21 22 23 24
25 30 29 28 27 26 25
36 31 32 33 34 35 36
6 5 4 3 2 1 31

(Joins sheet 2)

560 000 FEET

1 020 000 FEET

(Joins sheet 5)

R. 104 W. | R. 103 W.

N

3 Miles
2
15 000 Feet
10 000
5 000

Scale 1:31 680

5 000 4 000 3 000 2 000 1 000 0 0 5 000

1 ¾ ½ ¼ 0 1

MESA COUNTY AREA, COLORADO — SHEET NUMBER 2

R. 103 W. | R. 102 W.

1 060 000 FEET

GARFIELD COUNTY

570 000 FEET

560 000 FEET

1 030 000 FEET

(Joins sheet 1)

(Joins sheet 3)

(Joins sheet 6)

T. 9 S. | T. 8 S.

N

3 Miles

15 000 Feet

2

10 000

Scale 1:31 680

5 000

1

5 000 4 000 3 000 2 000 1 000 0 0 1 000 2 000 3 000 4 000 5 000

Land division corners are approximately positioned on this map.

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MESA COUNTY AREA, COLORADO NO. 2

MESA COUNTY AREA, COLORADO NO. 3

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Land division corners are approximately positioned on this map.

1 070 000 FEET

1 570 000 FEET

GARFIELD COUNTY

Ruby Lee Reservoir

Coal Gulch

Wash

Mack Wash

Big Salt Wash

Coyote Wash

Lipan Wash

SOIL SURVEY OF MESA COUNTY AREA, COLORADO

LIMIT

T. 9 S. | T. 8 S.

R. 102 W. | R. 101 W.

1 100 000 FEET

550 000 FEET

(Joins sheet 2)
(Joins sheet 4)
(Joins sheet 7)

3

N

3 Miles
2
1

15 000 Feet
10 000
5 000

Scale 1:31 680

(4)

N

3 Miles 2 1 0 15 000 Feet 10 000 5 000

Scale 1:31 680

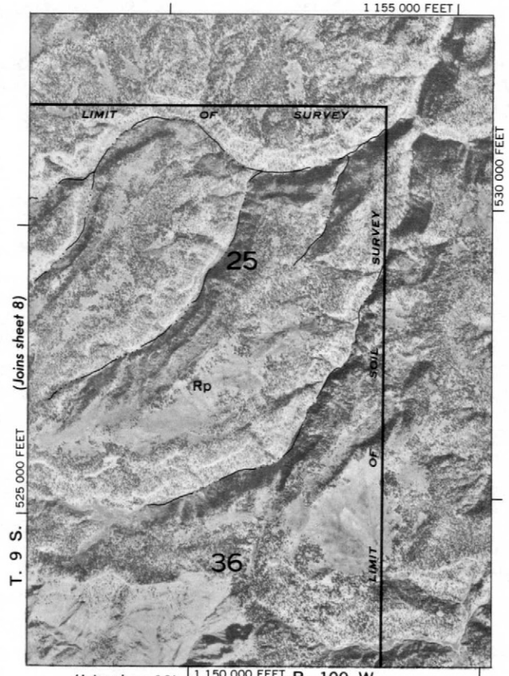
1 140 000 FEET

570 000 FEET

530 000 FEET

525 000 FEET

T. 9 S.

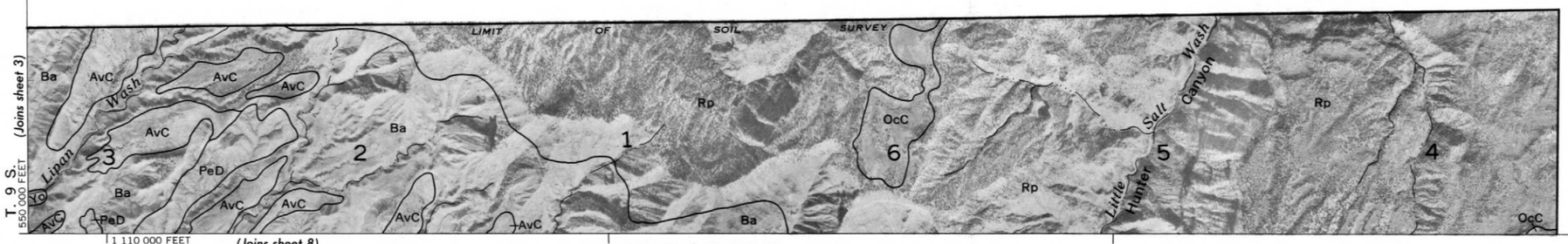


(Joins sheet 8)

1 155 000 FEET

(Joins sheet 12) 1 150 000 FEET R. 100 W.

5 000-FOOT GRID TICKS



(Joins sheet 3)

550 000 FEET

1 110 000 FEET

(Joins sheet 8)

R. 101 W. | R. 100 W.

Land division corners are approximately positioned on this map.
Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone, 1927 North American datum.
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MESA COUNTY AREA, COLORADO NO. 4

MESA COUNTY AREA, COLORADO — SHEET NUMBER 5

MESA COUNTY AREA, COLORADO NO. 5

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Land division corners are approximately positioned on this map.

990 000 FEET

550 000 FEET

(Joins sheet 1)

R. 104 W. | R. 103 W.

PeD

5

N

T. 9 S.

GRAND COUNTY

UTAH

West Salt Creek

Bauer Wash

GOVERNMENT HIGHLINE CANAL

SOIL SURVEY LIMIT OF SOIL SURVEY

6 and 50 Reservoir

GIA

530 000 FEET

(Joins sheet 6)

1 020 000 FEET

(Joins sheet 9)

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31 680

MESA COUNTY AREA, COLORADO — SHEET NUMBER 5

(Joins sheet 1)

990 000 FEET

550 000 FEET

R. 104 W. | R. 103 W.

PeD

T. 9 S.

GRAND COUNTY, UTAH

West Salt Creek

Bauer Wash

GOVERNMENT HIGHLINE CANAL

SOIL SURVEY LIMIT OF SOIL SURVEY

6 and 50 Reservoir

G.P.

FaC ChD Ba Bs AvC Bd Ro PeD Yo NeC BrC

(Joins sheet 6)

530 000 FEET

1 020 000 FEET

(Joins sheet 9)

N

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31 680

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Land division corners are approximately positioned on this map.

MESA COUNTY AREA, COLORADO — SHEET NUMBER 6

N

Scale 1:31 680

3 Miles 2 1 0 15 000 Feet 10 000 5 000

1 ½ 0 0 ¼ ½ ¾ 1

5 000 4 000 3 000 2 000 1 000

R. 103 W. | R. 102 W.

1 060 000 FEET

550 000 FEET

T. 2 N. | T. 9 S.

R. 1 W. | R. 1 E.

1 140 000 FEET

490 000 FEET

T. 1 N. | T. 9 S.

1 130 000 FEET

530 000 FEET

1 030 000 FEET

(Joins sheet 2)

(Joins sheet 11)

(Joins sheet 5)

(Joins sheet 16)

(Joins sheet 7)

(Joins sheet 10)

PeD Ba Bs ChD AvC Yo NIC Rp

Limit of soil survey

Government highline canal

Leach Creek

Mack Wash

Coyote Wash

Indian Wash

WALKER FIELD

Land division corners are approximately positioned on this map.

Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone, 1927 North American datum.

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MESA COUNTY AREA, COLORADO NO. 6

MESA COUNTY AREA, COLORADO — SHEET NUMBER 7

MESA COUNTY AREA, COLORADO NO. 7

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Land division corners are approximately positioned on this map.

1 070 000 FEET

550 000 FEET

T. 2 N. | T. 9 S.

R. 102 W. | R. 101 W.

(Joins sheet 3)

(Joins sheet 6)

R. 2 W. | R. 3 W.

(Joins sheet 8)

530 000 FEET

1 100 000 FEET

(Joins inset, sheet 15)

LIMIT OF SOIL SURVEY

GOVERNMENT HIGHLINE CANAL

Coyote Wash

Big Salt Wash

Dry Gulch

Lipan Wash

Salt Wash

Big Branch

East Wash

Yo

PeD

AvC

Ba

Bs

FaC

INSET

1 070 000 FEET

R. 3 W.

T. 1 N.

503 000 FEET

500 000 FEET

1 080 000 FEET

(Joins sheet 10)

(Joins sheet 15)

COLORADO RIVER

GIA

Rp

Ro

BtD

3000 AND 5000-FOOT GRID TICKS

7

N

3 Miles

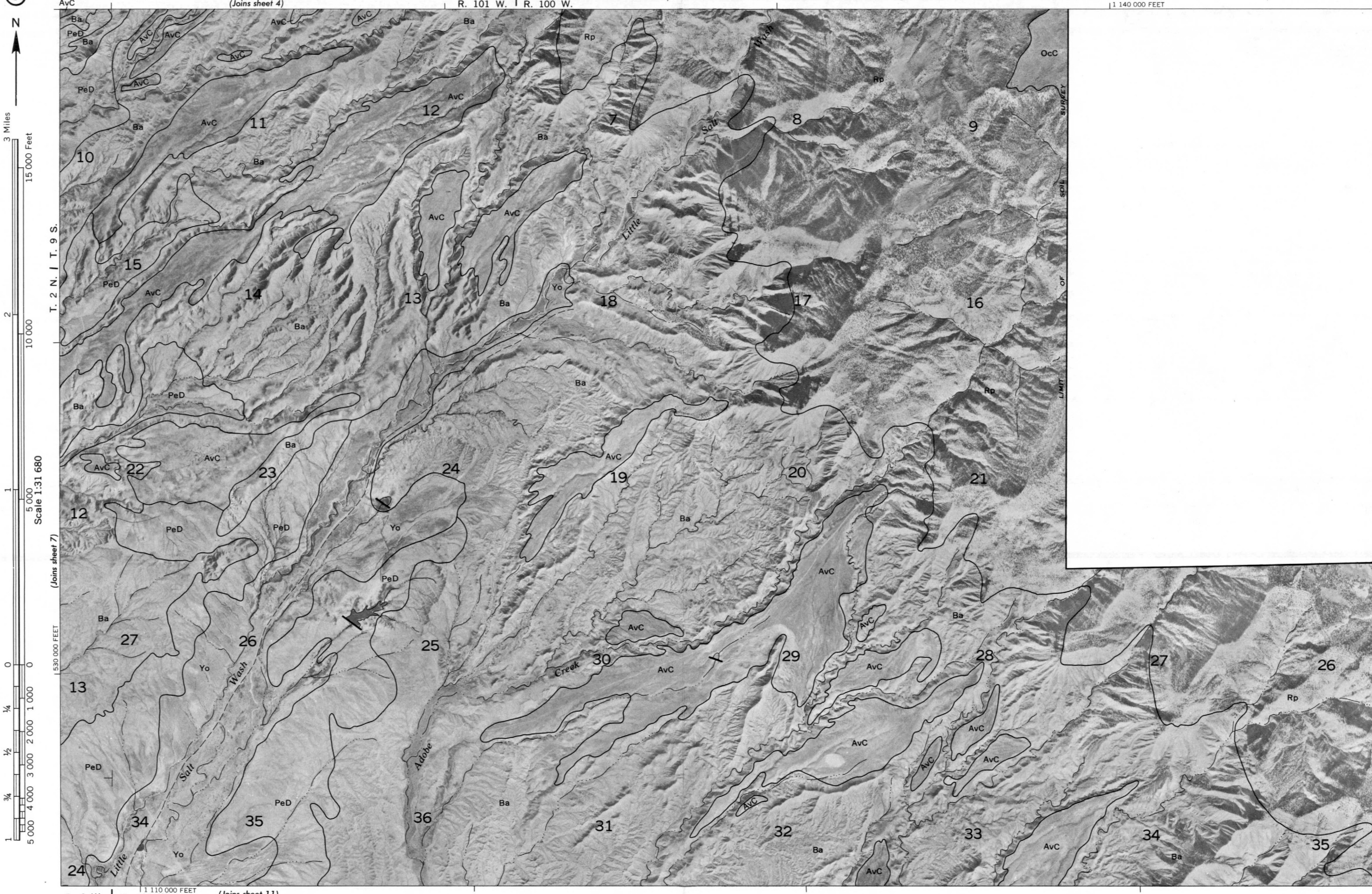
15 000 Feet

10 000

5 000

Scale 1:31 680

MESA COUNTY AREA, COLORADO — SHEET NUMBER 8



Land division corners are approximately positioned on this map.

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MESA COUNTY AREA, COLORADO NO. 8

MESA COUNTY AREA, COLORADO — SHEET NUMBER 9

990 000 FEET

520 000 FEET

(Joins sheet 5)

R. 104 W. | R. 103 W.

T. 10 S. | T. 9 S.

9

N

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31 680

(Joins sheet 10)

1 020 000 FEET

(Joins sheet 13)

1 500 000 FEET

UTAH

COLORADO

GRAND COUNTY

Rabbit Valley

McDonald Creek

McDonald Creek

Mee Canyon

Ruby Canyon

RIVER

DENVER AND RIO GRANDE WESTERN

Ruby

Shale

Bs PeD Ba NeC BrC FaC NIC AvC GIA Rp DwC Ro PoC Yo

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

50 70

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Land division corners are approximately positioned on this map.

MESA COUNTY AREA, COLORADO NO. 9

(10)

MESA COUNTY AREA, COLORADO — SHEET NUMBER 10

N

3 Miles 15 000 Feet

2 10 000

1 5 000

Scale 1:31 680

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000 FEET

1 030 000 FEET

(Joins sheet 14)

R. 103 W. | R. 3 W.

(Joins sheet 9)

(Joins inset, sheet 7)

T. 10 S. | T. 9 S.

T. 1 N. | T. 2 N.

1 060 000 FEET

520 000 FEET

(Joins sheet 6)

Land division corners are approximately positioned on this map.

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MESA COUNTY AREA, COLORADO NO. 10

(10)

N

3 Miles 15 000 Feet

2 10 000

1 5 000

Scale 1:31 680

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000 5 000

T. 10 S. | T. 9 S.

(Joins sheet 6)

1 060 000 FEET

520 000 FEET

T. 2 N. | T. 1 N.

(Joins inset, sheet 7)

(Joins sheet 9)

500 000 FEET

1 030 000 FEET

(Joins sheet 14)

R. 103 W. | R. 3 W.

PeD NIC Rp Ro Ba DwC AvC Yo FaC BtD GIA

Salt Creek

WESTERN RIO GRANDE TUNNEL DENVER AND LIMIT OF SURVEY

Horsethief Canyon

COLORADO RIVER

Bull Canyon

Rattlesnake Canyon

Pollock Canyon

Land division corners are approximately positioned on this map.

Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.

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MESA COUNTY AREA, COLORADO NO. 10

MESA COUNTY AREA, COLORADO NO. 11

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Land division corners are approximately positioned on this map.

R. 2 W. | R. 101 W. — 1 110 000 FEET — R. 101 W. | R. 100 W.

520 000 FEET

(Joins inset, sheet 15)

(Joins sheet 8)

T. 10 S. | T. 9 S.

N. | T. 10 S. (Joins sheet 12)

T. 1 N. |

500 000 FEET

(Joins inset, sheet 6)

1 140 000 FEET — R. 1 W. | R. 1 E.

11

N

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31 680

5 000 4 000 3 000 2 000 1 000 0

1 ¾ ½ ¼ 0 1

MESA COUNTY AREA, COLORADO — SHEET NUMBER 12

(Joins inset, sheet 4)

R. 100 W. | R. 99 W.

1 180 000 FEET

520 000 FEET

T. 9 S. | T. 10 S.

N

3 Miles

15 000 Feet

2

10 000

1

5 000

Scale 1:31 680

T. 10 S. | T. 1 N.

0 ¼ ½ ¾ 1

5 000 4 000 3 000 2 000 1 000 0

500 000 FEET

(Joins sheet 11)

1 150 000 FEET

(Joins sheet 16)

R. 1 E. | R. 99 W.

Land division corners are approximately positioned on this map.

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MESA COUNTY AREA, COLORADO NO. 12

MESA COUNTY AREA, COLORADO — SHEET NUMBER 13

MESA COUNTY AREA, COLORADO NO. 13

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Land division corners are approximately positioned on this map.

990 000 FEET

500 000 FEET

R. 104 W. | R. 103 W.

(Joins sheet 9)

T. 11 S. | T. 10 S.

1 020 000 FEET

480 000 FEET

R. 104 W. | R. 103 W.

(Joins sheet 18)

(Joins sheet 14)

13

N

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31 680

UTAH

COLORADO

GRAND COUNTY

RIVER

Utaline

DENVER AND RIO GRANDE WESTERN

McDonald Creek

Moore Bottom

Moore Canyon

Knowles Canyon

Long Mesa

Mee Canyon

Ba BrC DwC PaC PoC Ro Rp Yo

31 32 33 34 35 36 31

6 5 4 3 2 1 6 5

7 8 9 10 11 12 7 8

18 17 16 15 14 13 18 17

19 20 21 22 23 24 19 20

N

Scale 1:31 680

3 Miles 2 1 0

15 000 Feet 10 000 5 000

5 000 4 000 3 000 2 000 1 000 0

1 1/4 1/2 3/4 1

(Joins sheet 10)

R. 103 W. | R. 3 W.

1 060 000 FEET

490 000 FEET

T. 11 S. | T. 10 S.

(Joins sheet 13)

480 000 FEET

1 030 000 FEET

(Joins sheet 19)

R. 103 W. | R. 102 W.

(Joins sheet 15)

T. 11 S. | T. 1 N.

Mee Canyon

Rattlesnake Canyon

Pollock Canyon

West Fork

East Fork

BLACK RIDGE

Ro Rp PoC DwC AvC PaC BrC DoC

Land division corners are approximately positioned on this map.

Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

MESA COUNTY AREA, COLORADO NO. 14

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone, 1927 North American datum.
Land division corners are approximately positioned on this map.

N

1 070 000 FEET

R. 3 W. | R. 2 W.

(Joins inset, sheet 7)

1 095 000 FEET

R. 2 W.

(Joins sheet 7)

520 000 FEET

490 000 FEET

510 000 FEET

T. 2 N.

(Joins sheet 11)

1 105 000 FEET

T. 11 S. | T. 1 N.

(Joins sheet 14)

480 000 FEET

T. 11 S. | T. 1 N.

1 100 000 FEET

(Joins sheet 20)

R. 102 W. | R. 101 W.

COLORADO RIVER

Colorado River

Canyon

Creek

Flume

Canyon

Devils

Canyon

Fruita

Reservoir

TUNNEL

Fruita

Saddlehorn Campground

Colorado Natl Monument Headquarters

COLORADO NATIONAL MONUMENT

Monument Canyon

Canyon

Canyon

Wash

Hunter

Little

Sal

LIMIT OF SOIL SURVEY

GOVERNMENT

HIGHLINE CANAL

LIMIT OF SURVEY

GIB

3 Miles

2

1

15 000 Feet

10 000

5 000

Scale 1:31 680

MESA COUNTY AREA, COLORADO — SHEET NUMBER 16

(Joins sheet 12)

(Joins inset, sheet 6)

(Joins sheet 17)

(Joins sheet 22)

1 180 000 FEET

1 490 000 FEET

1 470 000 FEET

1 150 000 FEET

N

3 Miles

2

1

0

15 000 Feet

10 000

5 000

0

Scale 1:31 680

5 000 4 000 3 000 2 000 1 000 0

1 ¾ ½ ¼ 0

T. 1 N.

T. 11 S. | T. 10 S.

R. 1 E. | R. 99 W.

R. 99 W. | R. 98 W.

R. 1 E. | R. 99 W.

INDIAN WASH FLOOD PREVENTION DAM

Mount Garfield

Indian Wash

Lewis Wash

Coal Canyon

Moulton Valley

SOIL SURVEY LIMIT OF

AvC — Avalanche channery loam, 3 to 15 percent slopes

Ba — Badland

Rp — Rock outcrop-Persayo complex

UfC — Ustic Torriorthents-Fluventic Haplocambids complex, 3 to 15 percent slopes

Yo — Yoas loam, 0 to 3 percent slopes

Land division corners are approximately positioned on this map.

Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.

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MESA COUNTY AREA, COLORADO NO. 16

1 190 000 FEET

490 000 FEET

(Joins sheet 16)

T. 1 S. | T. 11 S.

T. 11 S.

R. 2 E. | R. 98 W.

(Joins sheet 23)

1 220 000 FEET

470 000 FEET

N

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31 680

5 000 4 000 3 000 2 000 1 000 0 0 ¼ ½ ¾ 1

MESA COUNTY AREA, COLORADO NO. 17

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.
Land division corners are approximately positioned on this map.

N

3 Miles 2 1

15 000 Feet 10 000 5 000

Scale 1:31 680

5 000 4 000 3 000 2 000 1 000 0 0

¼ ½ ¾ 1

R. 104 W. | R. 103 W.

1 020 000 FEET

1 470 000 FEET

1 450 000 FEET

990 000 FEET

(Joins sheet 13)

(Joins sheet 19)

(Joins sheet 24)

T. 11 S. | T. 12 S.

UTAH — COLORADO

GRAND — COUNTY

Wrigley Mesa

Jones Canyon

Knowles Canyon

Sieber Canyon

Toms Canyon

Little Dolores River

Dolores River

Ro Rp PaC DwC PoC GlA GlB Gu BrC

Land division corners are approximately positioned on this map.

Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

(Joins sheet 13)

R. 104 W. | R. 103 W.

1 020 000 FEET

1 470 000 FEET

T. 12 S. | T. 11 S.

(Joins sheet 19)

1 990 000 FEET

(Joins sheet 24)

N

3 Miles 2 1 0 15 000 Feet 10 000 5 000

Scale 1:31 680

5 000 4 000 3 000 2 000 1 000 0 5 000 ¾ ½ ¼ 0 1

1 450 000 FEET

UTAH — COUNTY — GRAND

Wrigley Mesa

Jones Canyon

Knowles Canyon

Sieber Canyon

Little Dolores River

Dolores River

Toms Canyon

Little Dolores River

Dolores River

Ro Rp PaC DwC PoC GlA GlB Gu BrC

Land division corners are approximately positioned on this map.

Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

MESA COUNTY AREA, COLORADO NO. 18

MESA COUNTY AREA, COLORADO NO. 19

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.
Land division corners are approximately positioned on this map.

(Joins sheet 14)
(Joins sheet 18)
(Joins sheet 20)
(Joins sheet 25)

1 030 000 FEET
470 000 FEET
450 000 FEET
1 060 000 FEET

R. 103 W. | R. 102 W.

T. 11 S. | T. 12 S.

Knowles Canyon
Sieber Canyon
Twenty-eight Hole Wash
Battleship Rock
Bottle Rock
Wash Canyon Trail

Ro Rp PoC DoC BrC DwC Lo PaC GIA

N

3 Miles
15 000 Feet
2
10 000
1
5 000
0
Scale 1:31 680
1 000
¼
2 000
½
3 000
¾
4 000
1
5 000

MESA COUNTY AREA, COLORADO — SHEET NUMBER 20

(Joins sheet 15)

R. 102 W. | R. 101 W.

1 100 000 FEET

470 000 FEET

N

3 Miles — 15 000 Feet — 10 000

Scale 1:31 680

5 000 4 000 3 000 2 000 1 000 0 5 000

(Joins sheet 19)

450 000 FEET

1 070 000 FEET

(Joins sheet 26)

(Joins sheet 21)

T. 12 S. | T. 11 S.

Monument Canyon

Monument Mesa

COLORADO NATIONAL MONUMENT

Ute Canyon

Thompson Reservoir No. 3

Thompson Reservoir No. 2

Thompson Reservoir No. 1

Trail Canyon

Wash

Red Canyon

Columbus Canyon

No Thoroughfare Canyon

Creek

Trail

GIB

Land division corners are approximately positioned on this map.

Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

MESA COUNTY AREA, COLORADO NO. 20

MESA COUNTY AREA, COLORADO NO. 21

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.
Land division corners are approximately positioned on this map.

1 110 000 FEET

470 000 FEET

R. 101 W. | R. 1 W.

T. 12 S. | T. 11 S.

(Joins sheet 20)

18 19 20 21

35

NIC

Easter Hill

Ba

Creek

Canyon

GIB

Rp

Red

Gu

30 29 28 27

GIA

Ro

BrC

TUNNEL

Thoroughfare

LkE

Yo

2 31 32 33 34 35 36

11 8 9 10

COLORADO NATIONAL MONUMENT

NeC

DwC

14 13 18 17 16 15 14

R. 101 W. | R. 100 W.

REDLANDS CANAL

REDLANDS DAM

GRAVEL PIT

BtD

RR AND RIG GRANDE WESTERN

GUNNISON RIVER

PeD

31 6

Billings Canyon

(Joins sheet 27)

1 140 000 FEET

R. 1 W. | R. 1 E.

R. 100 W. \ R. 1 E.

(Joins sheet 22) T. 2 S. | T. 1 S.

450 000 FEET

3 Miles

2

1

0

15 000 Feet

10 000

5 000

0

¼

½

¾

1

1 000

2 000

3 000

4 000

5 000

Scale 1:31 680

N

Scale 1:31 680

3 Miles 2 1 0 15 000 Feet 10 000 5 000

5 000 4 000 3 000 2 000 1 000 0 5 000

1 ¾ ½ ¼ 0 1

1 180 000 FEET

1210 000 FEET

R. 2 E. | R. 98 W. R. 98 W. | R. 97 W.

(Joins sheet 35)

(Joins sheet 40)

T. 14 S. | T. 3 S.

1380 000 FEET

385 000 FEET

460 000 FEET

1 190 000 FEET

5000 AND 10000-FOOT GRID TICKS

DELTA COUNTY

D AND RG W

GUNNISON RIVER

Big Wash

Creek

Windy Creek

Deer Creek

50

789

28 27 26 25 1 6 33 34 35 36 8 9 17 16 21 19 20 29 30 31 32 5 4 3 2

NeC LkE Ba Ro Bd Bs UoD Us PeD AvA BtD GIA

1 150 000 FEET

(Joins sheet 28)

(Joins sheet 21)

T. 2 S. | T. 1 S. (Joins sheet 23)

R. 1 E. | R. 2 E.

Land division corners are approximately positioned on this map.

Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone, 1927 North American datum.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

MESA COUNTY AREA, COLORADO NO. 22

MESA COUNTY AREA, COLORADO — SHEET NUMBER 23

(Joins sheet 17)

R. 2 E. | R. 98 W. | R. 98 W. | R. 97 W.

1 190 000 FEET

460 000 FEET

(Joins sheet 22)

T. 2 S. | T. 1 S.

T. 12 S. | T. 11 S.

1 450 000 FEET

1 220 000 FEET

(Joins sheet 29)

23

N

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31 680

MESA COUNTY AREA, COLORADO NO. 23

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.
Land division corners are approximately positioned on this map.

Horse Mountain

The Blowout

Wilson Creek

Big Sink

Halls Creek

Basin Wash

Guild Reservoir

Lockhart Draw

Whitewater Creek

GRAND MESA NATIONAL FOREST SOIL SURVEY LIMIT OF

(Joins sheet 18)

R. 104 W. | R. 103 W.

1 020 000 FEET

440 000 FEET

430 000 FEET

990 000 FEET

(Joins sheet 30)

(Joins sheet 25)

T. 13 S. | T. 12 S.

N

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31 680

5 000 4 000 3 000 2 000 1 000 0 0

1 ¾ ½ ¼ 0

UTAH

COUNTY

GRAND

Little Dolores River

Toms Canyon

Fish Canyon

Kings Canyon

East Fork Middle Canyon

Middle Fork Canyon

Coates Creek

Hill Creek

Biester Creek

Coates Creek School

BrC PaC PoC Rp GlA DwC MpC UnC GlB Ro

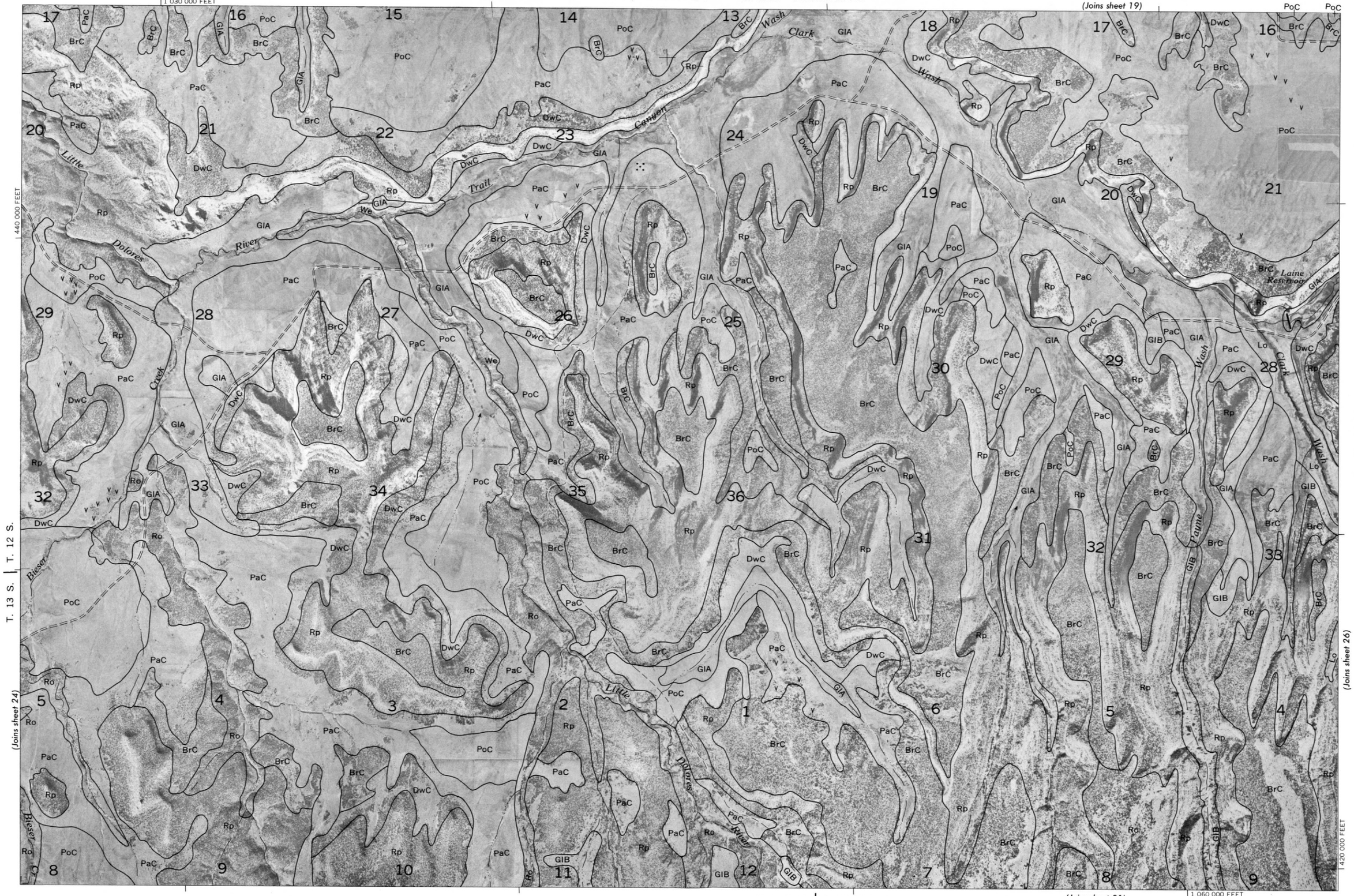
Land division corners are approximately positioned on this map.

Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

MESA COUNTY AREA, COLORADO NO. 24

MESA COUNTY AREA, COLORADO — SHEET NUMBER 25



MESA COUNTY AREA, COLORADO NO. 25

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.
Land division corners are approximately positioned on this map.

25

N

3 Miles
2
1

15 000 Feet
10 000
5 000

1
¾
½
¼
0

1 000
2 000
3 000
4 000
5 000

Scale 1:31 680

(26)

MESA COUNTY AREA, COLORADO — SHEET NUMBER 26

N

3 Miles 15 000 Feet 10 000 5 000

Scale 1:31 680

(Joins sheet 20) R. 102 W. | R. 101 W. 1 100 000 FEET

440 000 FEET

T. 13 S. | T. 12 S.

1 070 000 FEET

420 000 FEET

(Joins sheet 25)

(Joins sheet 32)

(Joins sheet 27)

Land division corners are approximately positioned on this map.

Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone, 1927 North American datum.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

MESA COUNTY AREA, COLORADO NO. 26

MESA COUNTY AREA, COLORADO — SHEET NUMBER 27

R. 101 W. | R. 100 W.

1 110 000 FEET

440 000 FEET

(Joins sheet 21)

R. 1 E.

27

N

T. 2 S.

COLORADO NATL. MONUMENT

Horse Point

Canyon

Creek

GUNNISON RIVER

Billings

Mesa

Rough

Ladder

Horse

Canyon

Ba

Rp

Ro

NIC

NeC

LkE

BrC

DwC

PaC

T. 13 S. | T. 12 S.

(Joins sheet 26)

(Joins sheet 28)

(Joins sheet 33)

1 140 000 FEET

420 000 FEET

Ladder Creek

Clarks Bench

Bangs Canyon

West MESA ISLAND

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31 680

MESA COUNTY AREA, COLORADO NO. 27

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.
Land division corners are approximately positioned on this map.

(Joins sheet 22)

R. 1 E. | R. 2 E.

1 180 000 FEET

1 440 000 FEET

N

3 Miles

15 000 Feet

10 000

Scale 1:31 680

5 000

(Joins sheet 27)

R. 99 W. / R. 1 E.

T. 13 S. | T. 12 S.

T. 2 S.

1 420 000 FEET

(Joins sheet 29)

(Joins sheet 34)

1 150 000 FEET

R. 99 W.

Land division corners are approximately positioned on this map.

Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone, 1927 North American datum.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

MESA COUNTY AREA, COLORADO NO. 28

MESA COUNTY AREA, COLORADO — SHEET NUMBER 29

MESA COUNTY AREA, COLORADO NO. 29

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station. Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks based on the Colorado coordinate system, central zone, 1927 North American datum. Land division corners are approximately positioned on this map.

29

N

3 Miles

15 000 Feet

10 000

Scale 1:31 680

1 190 000 FEET

440 000 FEET

R. 2 E. | R. 98 W.

(Joins sheet 23)

T. 2 S.

(Joins sheet 28)

T. 13 S. | T. 12 S.

420 000 FEET

R. 98 W. | R. 97 W. (Joins sheet 35)

1 220 000 FEET

GRAND MESA NATIONAL FOREST BOUNDARY

GRAND MESA LIMIT OF NATL SOIL SURVEY FOREST BDY

Lockhart Draw

Whitewater Creek

Anderson Reservoir

Hallenbeck Reservoir

Juniata Reservoir

Yo Creek

Kannah Creek

North Mesa

Purdy Mesa

Reeder Mesa

Us UoD IdC Ba Bs PeD Gu Yo St ScC Rp

30

MESA COUNTY AREA, COLORADO — SHEET NUMBER 30

(Joins sheet 24)

R. 104 W. | R. 103 W.

1 020 000 FEET

420 000 FEET

N

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31 680

400 000 FEET

990 000 FEET

(Joins sheet 36)

(Joins sheet 31)

T. 14 S. | T. 13 S.

UTAH

COUNTY

GRAND

Spring Creek

Hill Creek

Coates Creek

Canyon Creek

McKenzie Creek

Hester Creek

Land division corners are approximately positioned on this map.

Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

MESA COUNTY AREA, COLORADO NO. 30

MESA COUNTY AREA, COLORADO — SHEET NUMBER 31

R. 103 W. | R. 102 W.

1 030 000 FEET

420 000 FEET

(Joins sheet 25)

(Joins sheet 30)

(Joins sheet 32)

(Joins sheet 37)

1 060 000 FEET

400 000 FEET

T. 14 S. | T. 13 S.

GRAND MESA NATIONAL FOREST

Little Dolores River

Bieser Creek

Little Park Wash

Half Press Creek

Little Dolores River

31

N

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31 680

MESA COUNTY AREA, COLORADO NO. 31

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station. Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone, 1927 North American datum. Land division corners are approximately positioned on this map.

(32)

N

R. 102 W. | R. 101 W.

MESA COUNTY AREA, COLORADO — SHEET NUMBER 32

(Joins sheet 26)

1 100 000 FEET

1 410 000 FEET

(Joins sheet 33)

(Joins sheet 31)

1 400 000 FEET

1 070 000 FEET

(Joins sheet 38)

T. 14 S. | T. 13 S.

3 Miles 15 000 Feet 2 10 000 1 5 000

Scale 1:31 680

5 000 4 000 3 000 2 000 1 000 0 0 1 000 2 000 3 000 4 000 5 000

Land division corners are approximately positioned on this map.

Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.
This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

MESA COUNTY AREA, COLORADO NO. 32

1 110 000 FEET

(Joins sheet 27)

1410 000 FEET

(Joins sheet 32)

1 140 000 FEET

(Joins sheet 39)

1400 000 FEET

(Joins sheet 34)

T. 13 S.

T. 14 S.

N

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31 680

MESA COUNTY AREA, COLORADO NO. 33

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.
Land division corners are approximately positioned on this map.

MESA COUNTY AREA, COLORADO — SHEET NUMBER 34

(Joins sheet 28)

R. 99 W. \ R. 1 E. | R. 1 E. | R. 2 E.

1 180 000 FEET

T. 3 S. | T. 2 S.

410 000 FEET

(Joins sheet 33)

400 000 FEET

T. 13 S. | T. 14 S.

(Joins sheet 40)

1 150 000 FEET

R. 99 W. \ R. 2 E.

(Joins sheet 35)

N

3 Miles

15 000 Feet

10 000

Scale 1:31 680

5 000

5 000 4 000 3 000 2 000 1 000 0 0

Land division corners are approximately positioned on this map.

Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone, 1927 North American datum.

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MESA COUNTY AREA, COLORADO NO. 34

MESA COUNTY AREA, COLORADO — SHEET NUMBER 35

MESA COUNTY AREA, COLORADO NO. 35

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.
Land division corners are approximately positioned on this map.

1 190 000 FEET

(Joins sheet 29)

T. 3 S. | T. 2 S.

R. 2 E. | R. 1 W.

1 410 000 FEET

(Joins sheet 34)

R. 98 W. | R. 97 W.

(Joins inset, sheet 22)

1 220 000 FEET

1 390 000 FEET

Kannah Creek

N. Kannah Creek

McDonald Reservoir

Cheney Reservoir

Indian Creek

Deer Creek

Bs Creek

SOIL SURVEY LIMIT OF NATIONAL FOREST

GRAND MESA BOUNDARY

DELTA COUNTY

T. 14 S. — T. 13 S.

35

N

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31 680

N

3 Miles 15 000 Feet 10 000 5 000 Scale 1:31 680

2 1 0 0 ¼ ½ ¾ 1

5 000 4 000 3 000 2 000 1 000 0 5 000

1 370 000 FEET

(Joins sheet 30)

R. 104 W. | R. 103 W.

1 020 000 FEET

1 390 000 FEET

T. 14 S.

UTAH

COUNTY

GRAND

Creek

Granite

Draw

Bull

1 990 000 FEET

(Joins sheet 41)

(Joins sheet 37)

Land division corners are approximately positioned on this map.

Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.

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MESA COUNTY AREA, COLORADO NO. 36

MESA COUNTY AREA, COLORADO — SHEET NUMBER 37

37

N

R. 103 W. | R. 102 W.

1 030 000 FEET

390 000 FEET

(Joins sheet 31)

(Joins sheet 36)

(Joins sheet 38)

(Joins sheet 42)

1 060 000 FEET

370 000 FEET

T. 14 S.

GRAND MESA NATIONAL FOREST

North Fork

Press Creek

Hau

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31 680

MESA COUNTY AREA, COLORADO NO. 37

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.
Land division corners are approximately positioned on this map.

(Joins sheet 32)

1 100 000 FEET

390 000 FEET

N

3 Miles

15 000 Feet

2

10 000

1

5 000

Scale 1:31 680

(Joins sheet 37)

370 000 FEET

GRAND MESA NATIONAL FOREST

Fruita Reservoir No. 2

Fruita Reservoir No. 3

Fruita Reservoir No. 1

North East Creek

Gobbo Reservoir

Enoch Lake

Black Pine Reservoir

Snyder Creek

Snyder Flats

Lobe Creek

North Mayflower Gulch

Fall Creek

T. 14 S.

(Joins sheet 39)

(Joins sheet 43)

1 070 000 FEET

R. 102 W. | R. 101 W.

Land division corners are approximately positioned on this map.

Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

MESA COUNTY AREA, COLORADO NO. 38

MESA COUNTY AREA, COLORADO NO. 39

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.
Land division corners are approximately positioned on this map.

1 110 000 FEET | R. 101 W. | R. 100 W.

390 000 FEET

T. 14 S.

(Joins sheet 38)

(Joins sheet 33)

(Joins sheet 40)

(Joins sheet 44)

370 000 FEET

1 140 000 FEET

39

N

3 Miles

15 000 Feet

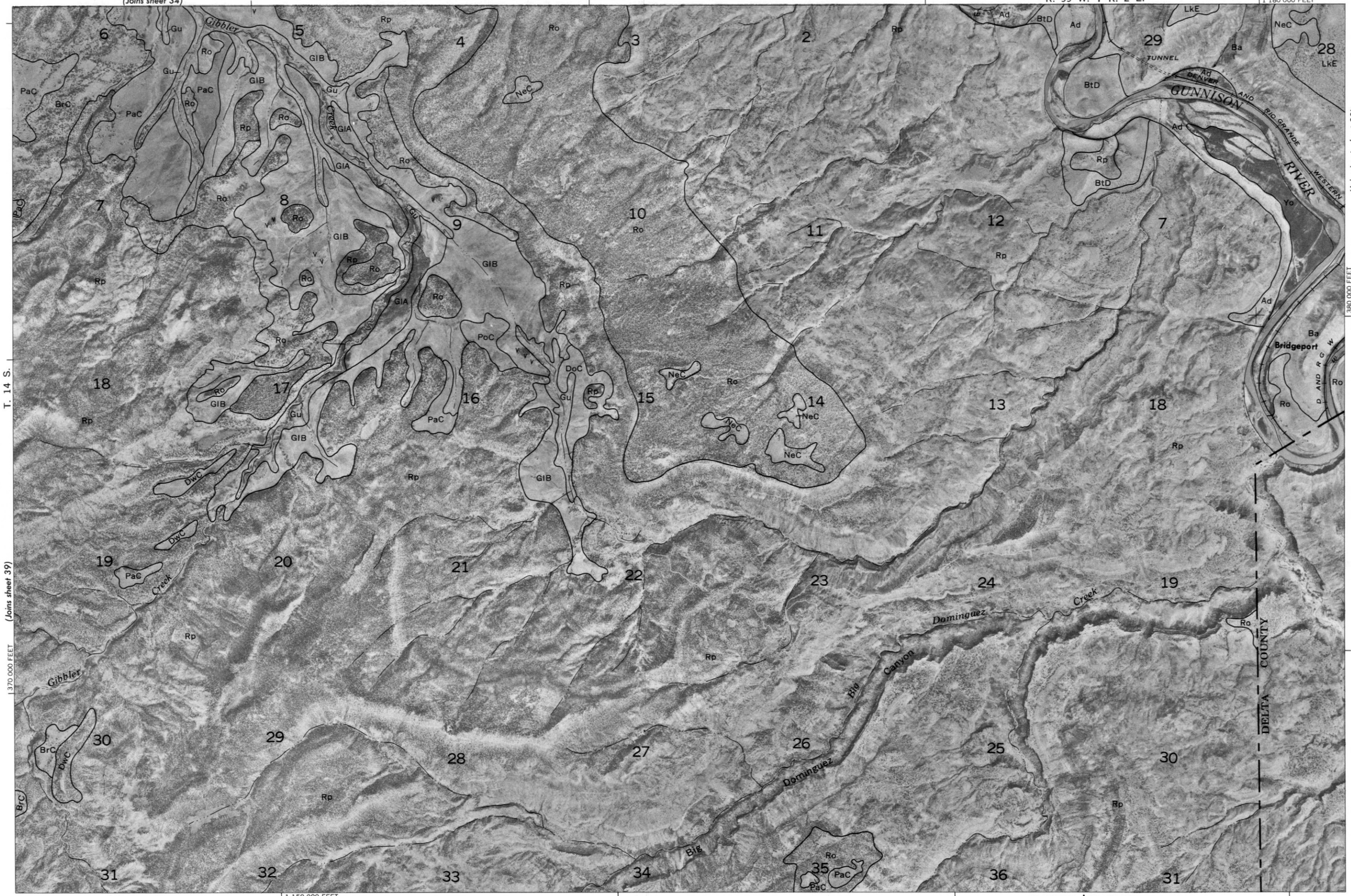
10 000

5 000

Scale 1:31 680

1 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000



3 Miles
15 000 Feet
2
10 000
1
5 000
Scale 1:31 680
0
¼
½
¾
1
1 000
2 000
3 000
4 000
5 000

Land division corners are approximately positioned on this map.

Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.

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MESA COUNTY AREA, COLORADO NO. 40

MESA COUNTY AREA, COLORADO NO. 41

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.
Land division corners are approximately positioned on this map.

990 000 FEET

R. 104 W. | R. 103 W.

(Joins sheet 36)

41

N

T. 15 S. | T. 14 S.

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31 680

360 000 FEET

350 000 FEET

(Joins sheet 42)

(Joins sheet 46)

1 020 000 FEET

UTAH

GRAND COUNTY

DOLORES RIVER

Bull Draw

Ro Rp St Ad OcC

N

(Joins sheet 37)

1 060 000 FEET

T. 15 S. | T. 14 S.

360 000 FEET

(Joins sheet 43)

(Joins sheet 41)

350 000 FEET

1 030 000 FEET

(Joins sheet 47)

R. 103 W. | R. 102 W.

Scale 1:31 680

3 Miles 2 1 0

15 000 Feet 10 000 5 000 0

5 000 4 000 3 000 2 000 1 000 0

1 ¾ ½ ¼ 0

North Fork

Turner Gulch

West Creek

Upper West Creek

(141)

OcC — Orchard City clay, 1 to 6 percent slopes

GcE — Gypsum land-Persayo complex, 25 to 65 percent slopes

MkD — Mikim-Rock outcrop complex, 6 to 25 percent slopes

MpC — Mikim-Persayo complex, 1 to 12 percent slopes

Rp — Rock outcrop-Persayo complex

St — Stumbo clay loam

UnC — Uncompahgre fine sandy loam, 1 to 12 percent slopes

LIMIT OF UNCOMPAHGRE NATIONAL FOREST SOIL BOUNDARY SURVEY

Land division corners are approximately positioned on this map.

Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone, 1927 North American datum.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

MESA COUNTY AREA, COLORADO NO. 42

MESA COUNTY AREA, COLORADO NO. 43

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.
Land division corners are approximately positioned on this map.

1 070 000 FEET

R. 102 W. | R. 101 W.

T. 14 S. | T. 15 S.

360 000 FEET

(Joins sheet 38)

(Joins sheet 44)

(Joins sheet 42)

1 065 000 FEET

299 000 FEET

(Joins sheet 50)

T. 50 N.

290 000 FEET

R. 17 W.

(Joins sheet 54)

1 075 000 FEET

1 100 000 FEET

340 000 FEET

9000 AND 10000-FOOT GRID TICKS

N

Scale 1:31 680

3 Miles 2 1

15 000 Feet 10 000 5 000

5 000 4 000 3 000 2 000 1 000 0 1 000 2 000 3 000 4 000 5 000

1 ¾ ½ ¼ 0 ¼ ½ 1

680

R. 101 W. | R. 100 W.

(Joins sheet 43)

(Joins sheet 39)

1 140 000 FEET

360 000 FEET

T. 15 S. | T. 14 S.

N

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31 680

5 000 4 000 3 000 2 000 1 000 0 0 ¼ ½ ¾ 1

35 UnC 36 31 32 33 34 35 36

Rp Ro BrC OcC PaC DoC DwC MpC GlB

Gibbler Creek

Big Dominguez Creek

Canyon

LIMIT OF UNCOMPAHGRE NATIONAL FOREST SOIL SURVEY BOUNDARY

1 2 3 4 5 8 9 10 11 12 13 14 15 16 23 24 25

(Joins Lower Right)

1 140 000 FEET | R. 100 W.

335 000 FEET

330 000 FEET

T. 15 S. (Joins sheet 48)

1 135 000 FEET

5 000-FOOT GRID TICKS

340 000 FEET

1 110 000 FEET

(Joins inset)

(Joins sheet 45)

Land division corners are approximately positioned on this map.

Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone, 1927 North American datum.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

MESA COUNTY AREA, COLORADO — SHEET NUMBER 44

R. 101 W. | R. 100 W.

(Joins sheet 43)

(Joins sheet 39)

1 140 000 FEET

360 000 FEET

T. 15 S. | T. 14 S.

(Joins sheet 45)

(Joins Lower Right)

1 140 000 FEET | R. 100 W.

335 000 FEET

(Joins sheet 48)

T. 15 S.

330 000 FEET

1 135 000 FEET

5 000-FOOT GRID TICKS

340 000 FEET

1 110 000 FEET

(Joins inset)

N

3 Miles

2

1

0

15 000 Feet

10 000

5 000

0

Scale 1:31 680

1 ¾ ½ ¼ 0

5 000 4 000 3 000 2 000 1 000 0

Land division corners are approximately positioned on this map.

Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone, 1927 North American datum.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

MESA COUNTY AREA, COLORADO — SHEET NUMBER 45

MESA COUNTY AREA, COLORADO NO. 45

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone, 1927 North American datum.
Land division corners are approximately positioned on this map.

1 150 000 FEET

R. 99 W. | R. 98 W. *(Joins sheet 40)*

T. 15 S. | T. 14 S.

360 000 FEET

(Joins sheet 44)

(Joins sheet 48)

1 180 000 FEET

1 340 000 FEET

45

N

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31 680

5 000 4 000 3 000 2 000 1 000 0 0
1 ¾ ½ ¼ 0 1

(Joins sheet 41)

R. 104 W. | R. 103 W.

1 020 000 FEET

340 000 FEET

T. 51 N. | T. 15 S.

(Joins sheet 47)

320 000 FEET

(Joins sheet 49)

990 000 FEET

R. 20 W. | R. 19 W.

N

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31 680

5 000 4 000 3 000 2 000 1 000 0

1 ¾ ½ ¼ 0

GRAND COUNTY

UTAH

THE PALISADE

DOLORES RIVER

Gateway

Bull Draw

West Creek

Canyon

Brown Canyon

John Creek

Lumsden

Larson

Rp Ro St GlA PoC PaC MpC

Land division corners are approximately positioned on this map.

Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.
This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

MESA COUNTY AREA, COLORADO NO. 46

MESA COUNTY AREA, COLORADO — SHEET NUMBER 47

(Joins sheet 42)

R. 103 W.

1 030 000 FEET

340 000 FEET

T. 51 N. | T. 15 S.

(Joins sheet 46)

R. 18 W.

(Joins sheet 50)

1 060 000 FEET

1 320 000 FEET

LIMIT OF UNCOMPAHGRE NATIONAL FOREST SOIL SURVEY BOUNDARY

Ute Creek

Casto Draw

West Creek

Canyon

Larson Canyon

Maverick Canyon

MpC

Rp

Ro

OcC

DoC

St

GIA

N

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31 680

MESA COUNTY AREA, COLORADO NO. 47

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone, 1927 North American datum.
Land division corners are approximately positioned on this map.

(Joins sheet 45)

(Joins inset, sheet 44)

(Joins sheet 51)

R. 99 W. | R. 98 W.

1 180 000 FEET

320 000 FEET

1 150 000 FEET

T. 51 N. | 330 000 FEET | T. 15 S.

N

3 Miles 2 1

15 000 Feet 10 000 5 000 0

Scale 1:31 680

1 0 ¼ ½ ¾ 1

5 000 4 000 3 000 2 000 1 000 0

Land division corners are approximately positioned on this map.

Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.

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MESA COUNTY AREA, COLORADO NO. 48

MONTROSE COUNTY | DELTA COUNTY

BOUNDARY — NATIONAL FOREST SOIL SURVEY

UNCOMPAHGRE LIMIT OF

MESA COUNTY AREA, COLORADO — SHEET NUMBER 49

R. 20 W. | R. 19 W.

990 000 FEET

310 000 FEET

(Joins sheet 46)

T. 50 N. | T. 51 N.

49

N

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31 680

(Joins sheet 50)

290 000 FEET

(Joins sheet 52)

1 020 000 FEET

UTAH

COLORADO

GRAND COUNTY

MANTI - LA SAL NATIONAL FOREST

DOLORES RIVER

TENDERFOOT MESA

Brown Creek

John Brown Canyon

Cave Canyon

Cottonwood Canyon

North Cottonwood

MpC — Mesa-Pinyon complex

Ro — Rock outcrop

Rp — Rock outcrop-Persayo complex

OcC — Orpha-Cryumbrept complex

St — Stumbo-Rock outcrop complex

PaC — Pinyon-Persayo complex

GeC — Gerst-Rock outcrop complex

BrC — Brownsto-Rock outcrop complex

GcE — Gerst-Rock outcrop complex

We — Wetherill loam

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Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone, 1927 North American datum.
Land division corners are approximately positioned on this map.

MESA COUNTY AREA, COLORADO NO. 49

(Joins sheet 47)

R. 18 W. | R. 17 W.

1 060 000 FEET

T. 50 N. | T. 51 N.

310 000 FEET

N

3 Miles

15 000 Feet

2

10 000

1

5 000

Scale 1:31 680

1 290 000 FEET

1 030 000 FEET

(Joins sheet 49)

(Joins sheet 53)

(Joins inset, sheet 43)

MAMMOTH MINES

TENDERFOOT MESA

Bull Canyon

Canyon

Maverick Canyon

Little Maverick Canyon

Flat Top Mesa

Calamity Mesa

Mountain

Potato

Creek

Calamity Creek

Indian Creek

UNCOMPAHGRE NATIONAL FOREST BOUNDARY

LIMIT OF SOIL SURVEY

OUTLAW MESA

OUTLAW MINES

DOLORES RIVER

St

141

Rp

Ro

DoC

MpC

GeC

GIB

OcC

31 32 33 34 3 2 1 7 10 11 12 18 15 14 13 22 23 24 19 20 17

Land division corners are approximately positioned on this map.

Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone, 1927 North American datum.

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

MESA COUNTY AREA, COLORADO NO. 50

MESA COUNTY AREA, COLORADO NO. 51

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone, 1927 North American datum.
Land division corners are approximately positioned on this map.

1 150 000 FEET — R. 14 W. — (Joins sheet 48)

310 000 FEET

T. 50 N. | T. 51 N.

300 000 FEET

OcC, Ro, Rp, OcE, BrC, GIB, Gu, Cr

31, 32, 33, 34, 35, 36, 6, 5, 4, 3, 2, 1, 7, 8, 9, 10, 11, 12

Escalante Creek, Escalante Fork, North Escalante Fork, East Escalante Fork

SOIL SURVEY LIMIT OF UNCOMPAHGRE NATIONAL FOREST

SURVEY BOUNDARY

MONTROSE COUNTY

1 170 000 FEET

INSET A

R. 20 W. | R. 19 W. — 990 000 FEET — (Joins sheet 52)

T. 49 N.

263 000 — 260 000

MpC, Ro, Rp, GIB, GIA, Ba

19, 20, 21, 22

MANTI-LA SAL NATIONAL FOREST — FOREST BDY

Salt Cr

GRAND CO. UT — MONTROSE COUNTY

1 020 000 FEET

1 000 AND 10 000-FOOT GRID TICKS

INSET B

T. 49 N. (Joins inset A)

262 000 — 259 000

1 030 000 FEET — R. 18 W. | R. 17 W. — (Joins sheet 53)

Rp, Ro, GeC, GIB

22, 23, 24, 19, 20

DOL R

North Fork Mesa Creek

MONTROSE COUNTY

1 050 000 FEET

1 000 AND 10 000 - FOOT GRID TICKS

INSET C

T. 49 N. (Joins inset B)

260 000 — 258 000

1 060 000 FEET — R. 17 W. | R. 16 W. — (Joins sheet 54)

Rp, Ro, PaC

20, 21, 22

Moon Canyon

South Fork Mesa Creek

LIMIT OF SURVEY

MONTROSE COUNTY

1 090 000 FEET

1 000 AND 10 000 - FOOT GRID TICKS

N

3 Miles — 15 000 Feet — 2 — 10 000

(Joins inset B) — (Joins inset C)

1 — 5 000 — 0 — 0 — 1 000 — ¼ — 2 000 — ½ — 3 000 — ¾ — 4 000 — 1 — 5 000

Scale 1:31 680

(52)

(Joins sheet 49)

R. 20 W. | R. 19 W.

1 020 000 FEET

N

3 Miles 2 1 0 15 000 Feet 10 000 5 000

Scale 1:31 680

MANTI - LA SAL NATIONAL FOREST

GRAND COUNTY UTAH

MANTI - LA SAL NATIONAL FOREST

Cone Mountain

Sinbad Valley

Sewemup Mesa

Salt Canyon Creek

Salt Creek

Rp Ro MpC MkD GcE OcC GIB GIA Ba

26 25 30 29 28 27 34 33 32 1 6 5 7 8 9 10 17 18 16 15 19 20 21 22

T. 49 N. | T. 50 N.

270 000 FEET

280 000 FEET

990 000 FEET

(Joins inset A, sheet 51)

(Joins sheet 53)

Land division corners are approximately positioned on this map.

Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone, 1927 North American datum.
This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

MESA COUNTY AREA, COLORADO — SHEET NUMBER 53

MESA COUNTY AREA, COLORADO NO. 53

This map is one of a set compiled in 1974 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.
Land division corners are approximately positioned on this map.

1 030 000 FEET

R. 18 W. | R. 17 W.

(Joins sheet 50)

53

N

280 000 FEET

(Joins sheet 52)

T. 49 N. | T. 50 N.

(Joins sheet 54)

270 000 FEET

1 050 000 FEET

(Joins inset B, sheet 51)

3 Miles

2

1

0

15 000 Feet

10 000

5 000

Scale 1:31 680

5 000 4 000 3 000 2 000 1 000 0

1 ¾ ½ ¼ 0

Juanita Arch

Canyon

Maverick Canyon

Little Maverick Canyon

Salt Cr.

Calamity Creek

Blue Creek

DOLORES RIVER

Mesa Creek

North Fork Mesa Creek

GIB

GeC

Ro

Rp

DoC

141

54

MESA COUNTY AREA, COLORADO — SHEET NUMBER 54

(Joins inset, sheet 43)

R. 17 W. | R. 16 W.

1 090 000 FEET

280 000 FEET

T. 49 N. | T. 50 N.

N

3 Miles

15 000 Feet

10 000

Scale 1:31 680

5 000

Blue Creek

Dark Canyon

Rp

Mkd

Ro

29

28

27

YELLOWBIRD MINES

Creek

Mesa

Rp

32

33

34

Fork

Rp

UNCOMPAHGRE NATIONAL FOREST BOUNDARY

LIMIT OF SOIL SURVEY

North

Ro

5

4

3

Rp

Ro

PaC

GeC

SOIL SURVEY

LIMIT OF

(Joins sheet 53)

8

9

10

Canyon

Mesa

Moon

Creek

Rp

17

16

15

South Fork

Mesa Creek

1 060 000 FEET

(Joins inset C, sheet 51)

Land division corners are approximately positioned on this map.

Photobase from 1954 to 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. 1927 North American datum.

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MESA COUNTY AREA, COLORADO NO. 54